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THE VETERINARY JOURNAL

A MONTHLY REVIEW OF VETERINARY SCIENCE

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NOVEMBER, 1935.

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(*Article by* Harold R. Dew)

Photographs of sesamoids and affected joints.
(*Article by* V. Berwyn Jones)

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NOVEMBER, 1935.

Editorial

THE N.V.M.A. AND ITS BRANCHES.

THE membership of the N.V.M.A. does not absorb as many of the members of the profession as it ought to do, for a total of only 1,693 out of a profession of 3,440 is not by any means the top water mark; in fact it is very unsatisfactory. Numerous suggestions have been made from time to time as to the best way in which to increase this membership; but there is no doubt that if some of the more powerful branches would encourage the National to subsidise its local branches so that all members of the parent body automatically became members of the respective branches the result would not only augment the numbers, but also help to reduce the apathy, which is the greatest curse we have, and accounts for so little being done at times by the members of our profession.

THE TOTALISATOR AND VETERINARY RESEARCH.

SOME few years ago those who were in charge of the management of the Tote suggested that one of the first objects to which they would allot money should be the cause of Veterinary Science—especially Research; and the profession will read with grateful anticipation the remarks made by Lord Milton and Sir Clement Hindley at the Gimcrack dinner a few days ago at York.

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Lord Milton, who won the Gimcrack Stakes this year with his colt Paul Beg asked that the needs of Veterinary Science should be considered when the profits of the totalisator were distributed, and that the Board might be able to allot funds to enable research to be done to assist the elucidation of such important problems as the causes and prevention of red-worm infection in horses, sterility in mares, and coughing in race horses; all three of which diseases are at the present time the source of much loss and very great inconvenience to owners all over the country. After stating that the Government had for some years past provided large sums for the benefit of cattle, sheep and pigs, Lord Milton said that no one seemed to have done anything substantial for the horse.

Sir Clement Hindley, the Chairman of the Racecourse Betting Control Board, stated that substantial profits had been made by the totalisator this year, and that the turnover had reasonable hope of attaining a sum of over £6,000,000 this year (as compared with just over £5,000,000 last year); also, that of the substantial profit which accrued some £50,000 would be applied to the benefit of racing—subject to the approval of the Home Secretary. In commenting upon Lord Milton's suggestion of helping veterinary research, Sir Clement Hindley stated that they were now exploring the possibilities, and after consulting the Ministry of Agriculture there had been a discussion on the subject with the Agricultural Research Council, the result of which was to confirm the need for financial help.

Fifty thousand pounds would be applied to the benefit of racing, subject to the approval of the Home Secretary, and in this category the claim of veterinary science would also be given serious consideration.

It is good news for the profession to read that its members are at last receiving the support to which, although much belated, it is entitled.

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General Articles

ERADICATION OF BOVINE TUBERCULOSIS IN CANADA.

By Lt.-Col. T. DUNLOP-YOUNG, O.B.E., D.V.S.M., M.R.C.V.S., F.R.S.I.

Veterinary Adviser in Great Britain to the Canadian Government.

THE great Dominion of Canada is showing the Mother Country how to eradicate tuberculosis, and it may interest veterinarians in Britain to know how it is being done.

Reasons for Eradication of Tuberculosis.

(1) It is a menace to human health and life.

(2) The public is demanding dairy products obtained from healthy herds.

(3) It causes economic losses to livestock owners.

(4) Tuberculous herds are a poor market for valuable foodstuffs.

(5) It costs less to maintain a healthy herd than a tuberculous one.

(6) The value and general productivity of a healthy herd is much greater than that of a tuberculous one.

(7) There is a greater demand at much higher prices for accredited and restricted area cattle.

(8) In five years 2,576 car-loads of tuberculous cattle, or over fifty-one trains of 50 cars to a train, were consigned to the digesters by Federal Meat Inspectors, which means a waste of time and money in raising and feeding over 51,523 cattle.

Three plans are in operation :

Accredited Herd Plan.

The object of this plan is the eradication of tuberculosis in pure-bred breeding herds. These herds are tuberculin-tested free of charge by salaried veterinary inspectors. To be eligible for acceptance under this plan a herd must contain at least five pure-bred cattle of one breed registered in the applicant's name. The number of pure-bred must, however, comprise at least one-third of the total number of cattle in the herd. As soon as the herd has passed two annual or three semi-annual tests without a reactor and contains at least ten registered pure-breds, it is designated a " Tuberculous-free Accredited Herd."

Compensation is paid for reactors, and is based on two-thirds of the valuation placed upon the animals by veterinary inspectors of the Health of Animals Branch. The maximum amount of compensation permitted under the Act is 100 dollars for pure-breds and 40 dollars for grades. Compensation on a pure-bred basis will not be paid for reacting animals over six months of age not registered at the commencement of the tuberculin test. No compensation is, however, paid for cattle affected with lumpy jaw, or for grade bulls which react to the test.

All reactors must be slaughtered under Federal Inspection. There were 6,790 fully accredited herds at the end of March, 1935.

Supervised Herd Plan.

The supervised herd plan is a single herd policy applicable to grade herds irrespective of the number of pure-bred or grade animals they contain. No compensation is paid for reactors, but the owner receives whatever proceeds there may be from the salvage. Owners placing their herds under this plan must agree to slaughter reactors, to promptly cleanse and disinfect their premises, and to keep their cattle from coming in contact with untested animals. If a herd sire is not maintained on the premises, breeding operations must be restricted to a tested animal. There were 42,598 supervised herds at the end of March, 1935.

Restricted Area Plan.

The object of this plan is the eradication of tuberculosis in definite areas. At least two-thirds of the cattle owners in any definite area must sign a petition for the establishment of such an area under this plan. This petition must be forwarded by the Provincial Minister of Agriculture to the Minister of the Federal Department of Agriculture requesting that the necessary action be taken. The payment of compensation is based on the same limitations and maximum valuations provided under the Accredited Herd Plan.

Reasons for the Establishment of Restricted Areas for the Control of Bovine Tuberculosis.

(1) It is the most practical and economical method for the Department and for the livestock owners.

(2) It permits of organised systematic work in testing cattle and the shipment of reactors by car lots—the least expensive method.

(3) The greatest number of cattle can be tested in a given period.

(4) Greater permanent progress can be made in the control of this disease than by any other method, because all cattle in a definite area are under official supervision. They are all systematically tested, reactors shipped promptly for slaughter, and all infected premises cleansed and disinfected.

(5) All infected centres are readily located and the spread of infection controlled.

(6) It provides the best possible protection to clean herds and gives the owner a feeling of security.

(7) There is no necessity to erect double fences to protect clean herds while at pasture.

(8) It facilitates breeding operations, as they can be carried on between area herds of equal health status, and has a tendency to eliminate the scrub bull.

(9) It promotes the improvement of stock and does not restrict the services of valuable herd sires.

(10) It creates an active market at higher prices, as area cattle are in great

demand. Buyers for foreign markets demand tuberculosis-free cattle, and select areas to purchase their animals, as they obtain the number desired more quickly and at less travelling cost in areas than elsewhere.

(11) It provides a safer milk supply to all municipalities in the area, and at the same time is an effective means of controlling bovine tuberculosis.

(12) It results in better housing accommodation for cattle and better sanitary conditions in general, as officers advise owners regarding desirable improvements.

(13) More effective control and supervision can be maintained over areas than under single-herd policies, as the movement of cattle into an area is governed by regulations.

(14) Area work promotes community interest and co-operation and has a tendency to protect the general interest in an area against any action which may jeopardise its health status.

(15) It is popular with the stock owner, creates a ready market for their cattle, reduces the incidence of the disease, and is of importance to public health.

(16) It is essential to livestock interests to maintain progressive control of bovine tuberculosis, and with the present knowledge the restricted area plan is the most suitable and effective means applicable to Canada.

Regulations Relating to the Establishment and Maintenance of Restricted Areas.

Applications may be made to the Dominion Department of Agriculture by the Minister of Agriculture of the Provincial Government stating that the province is desirous of Federal aid in the eradication of bovine tuberculosis from a restricted area, upon and subject to the provisions of the regulations, and stating (*a*) the location and boundaries of the proposed area ; (*b*) the approximate number of cattle within it ; (*c*) that a majority consisting of at least two-thirds of the cattle owners in the proposed area are in favour of having their cattle tested for the eradication of tuberculosis ; and (*d*) that the Provincial Government, whenever requested by the Federal Department of Agriculture, will assist in the enforcement of these regulations by conducting prosecutions of persons accused of obstructing or refusing to assist Federal inspectors engaged in the work of testing cattle, and persons who in any way refuse to obey the regulations made hereunder :

Upon the approval of the Minister of Agriculture of any such application a proclamation may be published in the *Canada Gazette*, constituting the proposed area a restricted area within the meaning of these regulations, whereupon all provisions of these regulations shall apply to said restricted areas.

The said area shall be a quarantined area in so far as bovine tuberculosis is concerned. Cattle may only be moved into or out of the area under the following conditions :

(*a*) Fully accredited cattle accompanied by a certificate of a veterinary inspector may enter the area without test.

(*b*) Cattle from herds under the supervision of the Health of Animals Branch for the eradication of tuberculosis may enter the area without test if accompanied by a certificate signed by a veterinary inspector showing the date of the last test.

(*c*) Steers and heifers of a feeder type may be admitted into the area without test under the following conditions: They shall be accompanied by a licence issued by a veterinary inspector. They shall be isolated from other cattle and shall be submitted to a tuberculin test conducted by a veterinary inspector upon arrival at destination. Reactors shall be promptly removed for slaughter and no compensation shall be paid.

(*d*) Other cattle intended to remain within the area shall be subjected to the tuberculin test by a veterinary inspector or approved veterinarian before admittance to the area.

(*e*) Cattle for entry into the area for exhibition purposes or other temporary stay not covered by sections (*a*) and (*b*) shall be subjected to the tuberculin test by a veterinary inspector or approved veterinarian before admittance to the area.

(*f*) Cattle for immediate slaughter consigned to approved slaughterhouses only may be brought into the area without test, but shall not be allowed to come in contact with other cattle and shall be kept isolated on the premises until slaughter, provided, however, that any unfinished cattle so consigned may be held for feeding purposes under the following conditions: They shall be submitted to a tuberculin test by a veterinary inspector. Reactors shall be promptly removed for slaughter and no compensation shall be paid. Non-reactors shall be moved under licence to approved feeding premises where they shall be quarantined for a retest to be conducted after the expiration of a sixty-day period.

(*g*) Cattle in transit across the area by rail shall not be unloaded except at a point designated for that purpose, where they may be kept from contact with other cattle within the area.

(*h*) Cattle shall not be driven across the area by road unless special permission has been obtained in writing from the veterinary inspector in charge of the area.

Owners of cattle within the area will be required to assist the veterinary inspectors making the test by assembling the cattle when requested and giving whatever additional help as may be reasonably expected. Owners when requested must furnish meals and bed for the inspector while conducting the test. Suitable transportation from farm to farm within the area for the officers of the Health of Animals Branch must be provided by the Provincial Government.

Use of syndicate or joint bulls will be permitted in herds that are equally free from disease, but not otherwise. For instance, a bull from a herd that has contained reactors shall not be used in a herd that has passed a clean test.

All cattle within the area shall be submitted to the tuberculin test as soon as practicable by veterinary inspectors, or accredited veterinarians,* and shall be

* An accredited veterinarian for the purposes of these Regulations means a veterinary practitioner authorised by the Veterinary Director-General to conduct tests under the Regulations of the Health of Animals Branch.

retested whenever deemed necessary by the Veterinary Director-General. Reactors to the test shall be marked for identification and shall be disposed of by slaughter under inspection forthwith.

Whenever, in carrying out this Order, it is necessary to slaughter an animal or animals for the eradication of tuberculosis from a herd, the animal, or animals, unless otherwise provided, shall be valued and compensation awarded in accordance with sections 14 and 15 of the Animal Contagious Diseases Act. Compensation will not be paid for reacting grade bulls, or animals affected with lumpy jaw.

The feeding of animals within a restricted area on by-products of cheese factories, skimming stations and butter factories is prohibited unless the said by-products have first been sterilised by heat. The Minister may order the exclusion of public stock yards located within an established area from the provisions of these regulations. All premises and contact matter infected or suspected of being infected with tuberculosis shall be thoroughly cleansed and disinfected by and at the expense of the owner or occupier in a manner satisfactory to an inspector.

An area (county, municipality or district) in which the percentage of cattle infected with tuberculosis does not exceed one-half of one per cent. (0.5) shall be declared by the Veterinary Director-General an accredited area for a period of three years, and when a percentage of cattle infected with tuberculosis does not exceed two-tenths of one per cent. (0.2) it shall be declared an accredited area for a period of six years.

NOTE.—Compensation on a pure-bred basis will not be paid for reacting animals over six months of age, not registered at the commencement of the tuberculin test.

CATTLE TESTED UNDER THE RESTRICTED AREA PLAN.

(From inception to March 31st of each year.)

	Total number of cattle tested:	Number of animals under supervision:
1924	20,786	16,435
1925	78,799	68,880
1926	208,459	163,652
1927	280,515	233,885
1928	510,357	308,505
1929	721,426	628,734
1930	1,024,562	757,625
1931	1,402,441	1,115,131
1932	1,627,473	1,242,379
1933	1,849,981	1,378,436
1934	2,031,525	1,466,569
1935	2,189,584	1,537,253

CATTLE TESTED UNDER ALL POLICIES FOR TUBERCULOSIS ERADICATION.

(From inception to March 31st of each year.)

	Total number of cattle tested:	Number of Animals under supervision:
1916	2,332	2,332
1920	15,557	14,130
1925	400,627	240,648
1930	1,801,536	1,010,873
1931	2,289,770	1,388,527
1932	2,655,617	1,614,541
1933	3,089,885	1,926,554
1934	3,588,072	2,094,496
1935	4,007,130	2,251,771

The percentage of reactors has varied in different districts from 0.1 to 29.5.

The eradication is being carried out under the supervision of the Deputy Minister of Agriculture (Dr. Barton) and the Veterinary Director-General (Dr. Hilton).

SOME OBSERVATIONS ON THE PREVENTION OF BLOW-FLY ATTACK IN SHEEP.*

By WM. C. MILLER, M.R.C.V.S., F.R.S.E.

Royal Veterinary College, London; formerly of the Institute of Animal Genetics, Edinburgh University.

IT is proposed to describe in this short article the methods adopted during recent years at the Institute of Animal Genetics to control loss from attack by maggot-fly in sheep. The particular circumstances under which the methods to be described were employed were not perhaps an exact parallel to those under which sheep are kept on commercial sheep farms, and the methods may not in consequence be equally applicable under all farm conditions. It is, however, felt that the results were sufficiently striking to be worth recording, since, with minor modifications, they could be made use of on many low-ground farms where maggot-fly attack is severe.

The Sheep.—These consisted of various breeds and crosses kept for such experimental purposes as involved a study of inheritance of various wool characters —colour, fineness, kemp percentage, density and length of wool fibres, in particular. At different times, sheep of the following breeds or crosses have been used: Blackface, Cheviot, Half-bred, Greyface, Border Leicester, Lincoln, Shetland, and various Merino crosses.

As with all sheep kept in the near vicinity of large towns, where for various reasons the concentration of sheep blow-flies—both the "Greenbottle" (*Lucilia*

* Reproduced by the kind permission of the Author, and the Editor of *The Scottish Journal of Agriculture*.

sp.) and the " Bluebottle " (*Calliphora* sp.)—is greater than in purely rural surroundings, attack by fly was a source of continual trouble and expense throughout the summer months, and perhaps especially in July, August and September. In the years 1928 and 1929 it seemed practically impossible to control the flies. Pigs were being bred nearby under the open range system of management and were receiving considerable quantities of " brock " from hotels and institutions. The residue from this, containing as it did considerable amounts of meat refuse, provided optimum breeding conditions for the flies normally present. In effect, the fly population during these two summers was far above normal levels. During this time it was noticed that while the percentage of strikes among white-woolled sheep varied between fifteen and twenty, among brown-woolled sheep, and especially among the pure-bred Shetlands kept at the Institute, it was less than 0.5. Only one pure-bred brown Shetland (" mourrit ") ram lamb was attacked during three years, and this animal had previously been injured by fighting. So remarkable was the resistance against blow-fly shown by the Shetland sheep that special permission was obtained from the city veterinary authorities to have ten brown Shetland ewes exempted from summer dipping in 1929. At this time 174 sheep—rams, ewes and lambs—were dipped. The object was to attempt to concentrate fly on these undipped sheep by making all the others repulsive to them. The dipped sheep were dipped at intervals three times during that summer with an arsenic and sulphur dip, and on each occasion they were allowed to become quite dry before the ten brown ewes were put amongst them. None of the ten was attacked by fly during the whole summer, though on one occasion within two weeks, seven of the white-woolled *dipped* sheep were attacked —two ewes, four lambs and one Blackface adult ram (at the base of the horns).

Numerous attempts were made to define wherein lay this apparent immunity and to determine whether it could be incorporated into the white-woolled Shetlands or into cross-bred Shetlands, but without success. It does not appear to depend upon any recognisable difference in chemical composition of the wool suint, or length or density of the fleece. It is not transmitted to the white progeny between a white-woolled ram by brown Shetland ewe (white fleece colour being dominant to the recessive brown of the Shetland), but it is possessed by brown cross-bred sheep which have been extracted from Shetlands by a white breed and subsequently mated again to a brown parent.

Our conclusion, in the meantime, is that for some reason the brown colour of the wool of the Shetland is unattractive to the fly, rather than that it is actively repellent.

Dips and Dipping.—Endeavours were made to secure a dip that might reasonably be expected to protect ewes and lambs especially from maggot-fly. Most of the standard dips upon the market were tried at one time or another, but none could be relied upon to protect the sheep for more than ten to fourteen days, and when weather conditions were favourable to the fly, most dips would not protect for more than seven days with certainty. This is, of course, in keeping

with general observation and experience: it is not intended to be a reflection upon the characters or qualities of modern dips in general. To avoid a misunderstanding in this connection, it is desirable to consider the reproductive functions of the gravid female fly. When her abdomen is replete with eggs, there comes a times when it is imperative that these shall be deposited. If a soiled and dirty sheep happens to be within her range of flight, that sheep will be selected and will be struck; where no such sheep presents itself, another is chosen, and it may be a perfectly clean-woolled sheep or lamb which is struck

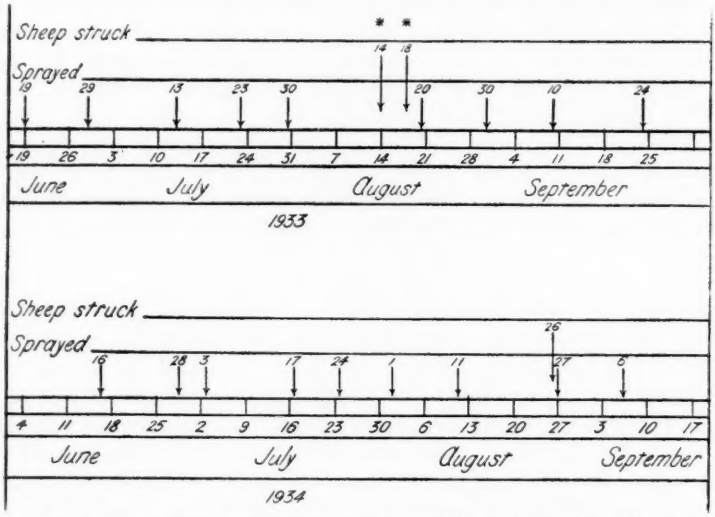

Diagram to illustrate the relationship between dates of spraying and dates when sheep were struck by maggot flies. * indicates that two sheep were struck. In 1934 on the 26th August one lamb was struck.

on the tail-head, shoulders, or loins. It does not apparently matter to the fly whether a little dip taint remains in the wool from a previous dipping; if the urge to lay eggs is strong enough the female fly will lay her eggs on the first sheep that she finds. With some dips, when this happens, the young maggots may be killed by contact with, or ingestion of, particles of poisonous dip deposited in the fleece, and no damage is done. Protection of this kind is, however, only of short duration, and it is not possible to rely entirely upon dipping to control maggot-fly attack.

Spraying.—For some time systematic spraying or "jetting" had been employed in Australia, New Zealand and other countries, but according to our information, it had not met with unqualified success. We decided, however, to utilise a method of spraying on a more intensive system than is possible where very large numbers of sheep have to be treated.

In our earlier attempts we used a powerful jet of a weak solution of a dis-

infectant, directed upwards so that when the sheep passed over it, it would saturate the belly and tail regions. The sheep were driven through an ordinary " shedder," and the nozzle was placed on the ground in it between bricks over which the sheep had to step. Strikes by fly still occurred and the nozzle was altered so that the jet was changed to a coarse spray. The method of applying the spray (from below upwards) was the same. The number of lambs struck around the tail was less, but the ewes were just as frequently struck, especially high up on the tail-head and over the shoulders. During this time only a selected number of sheep were being sprayed, so that some check could be kept on the results by comparison with those which were not sprayed.

Since the proportion of " clean strikes " (*i.e.*, strikes on clean areas of wool) was nearly as high as the proportion of " dirty strikes," and since by observation we noted that flies always approached the sheep from *above*, no matter where they ultimately settled, the underneath spray was abandoned for an overhead one. We also found that the finer the spray could be made, the better protection did the sheep get and the less was the waste of the spraying fluid. Moreover, if the spray was applied in the form of very fine droplets or globules, these penetrated deeper into the fleece than when the drops were large and would not cling to the wool. Finally, we employed the finest nozzle available, which is made for horticultural spraying against insect pests (" green-fly," etc.), and by various adjustments devised a method which, during the past two seasons (1933 and 1934, both bad fly years), has given us control of the blow-fly.

Spraying Solutions.—Many different kinds of repellent solutions and mixtures were tried. Some were solutions of common disinfectants as ordinarily used on farms, others were made up specially. Different strengths were used. Many of these had to be abandoned for one or another reason : thus, some were too expensive for frequent use ; others in ordinary strengths injured the eyes and were useless when further diluted ; others had too great a content of unemulsified tar oils or acids and stained the wool ; some had too much whale oil, and though giving quite satisfactory protection, caused the wool to handle greasily, and towards the end of summer resulted in particles of soot, dust and soil adhering to the fleece and making it very dirty. Those which have given the best results and which, we believe, can be relied upon to protect against strike, are those which fall into the category of " liquid fly dips," as prepared by various dip manufacturers. They must be completely soluble, must contain no solid particles which block up the fine nozzle necessary for satisfactory spraying, and must not separate out if they contain emulsified oils.

Method of Spraying.—It is perhaps unnecessary to describe all the steps that were taken before a satisfactory method was evolved.

The solution which we eventually used was made up in pailfuls of 2½ per cent. strength (4 oz. per gallon, or 1 pint to 5 gallons). This strength was adequate for all ordinary spraying, but in exceedingly bad fly periods, especially in warm, moist or thundery weather, it might be necessary to increase it to 3½ per cent.

(5½ oz. per gallon). Clean cold water was used, and the solution was thoroughly stirred to ensure that the mixture was uniform.

The sheep were driven into ordinary pens and packed loosely, so that while they had room to move round no great amount of ground was visible. Any fairly powerful garden syringe that will deliver a fine spray or mist is suitable. It may be operated by one man, or with large numbers of sheep it may be necessary to employ one of the powerful pump types of syringe, which can be clamped to the top rails of the pens ; one man then works the pump while a second manipulates the nozzle.

The best results are obtained when the fine spray is directed in a practically horizontal direction over the sheep from about the level of the operator's head, and allowed to drift across the pen over the heads and backs of the sheep on which it settles. Any endeavour to force the spray *into* the wool of each sheep results in the excess running off and being wasted. It is desirable to coat the sheep with the spray in very fine globules, until they have a somewhat " hoar-frosted " appearance.

The sheep nearest the operator move away as the spray falls on them and other replace them, so that in a very few minutes all the sheep in the pen have been covered. Under ordinary conditions, two gallons of solution are quite enough for each 100 sheep, provided the spray is fine. It takes one man about seven to ten minutes to spray each 100, not including the time taken to collect and return to pasture.

Where ewes and lambs are running together, a little care is required to ensure that lambs are not hurt in the pens, but in normal years low-ground lambs are generally quite robust enough to suffer no harm by the time the fly season begins —about the middle of June. It is perhaps desirable to point out that where very young lambs are being sprayed, fewer should be penned together, since the bigger bodies of the ewes tend to shelter the lambs from the spray, and they are not so efficiently covered when packed tightly.

On windy days, spraying should be done from the windy side of the pen, and the nozzle should be kept lower than usual.

It is remarkable how sheep, after the first time or two, get accustomed to coming in for spraying. They appear to enjoy the cooling effect of the spray over their heads, but may blink when some excess inadvertently gets into their eyes. No eye injuries resulted from the use of strengths up to 5 per cent., which is considerably stronger than is advocated.

Frequency of Spraying.—Under normal conditions it is not necessary to spray oftener than once every ten to fourteen days, according to the weather and the state of the wool. In very bad fly weather and just after clipping, when the wool does not " hold " the spray so well, once a week may be necessary. When hot weather follows heavy rain, or when heavy rain falls after spraying, an extra treatment may be required.

In order to test the efficiency of the method, our sprayings were interrupted at different times during the last two years, which, as mentioned, were very bad fly years. On each occasion sheep were struck between the fifteenth and the nineteenth day after the last spraying, as shown above.

It will be noted that in 1933 there were only four cases of strike among some 220 sheep and lambs, while in 1934, among 235 sheep there was only a single case. The flock each year was kept on about 30 acres of fairly rich grassland arranged in small paddocks of about three to five acres each. The system followed was to stock each of these heavily for a few days and then to change to another, the first being rested until its turn arrived when all had been grazed. This results in a great concentration of sheep upon a small area throughout the summer and gives greater opportunity for the flies to work than where sheep are scattered widely over a large acreage.

The author does not wish to claim any originality in the idea of spraying. The object of this article is to show that by suitable modifications, routine spraying can prevent flies from striking sheep even when these are kept under conditions favourable to the flies, provided it is carefully and conscientiously carried out.

There is no doubt that the expense and trouble involved in spraying are far less than must ordinarily be faced where sheep have to be caught and dressed almost daily. Further, the loss of condition, which is so especially pronounced when forward lambs are struck and which is always so marked a feature of maggot attack, is avoided. The system of spraying has been successfully practised by a considerable number of sheep farmers, and it can be recommended with confidence to low-ground flock-owners.

TULARÆMIA.*

By K. D. DOWNHAM, B.V.Sc., M.R.C.V.S., D.V.H.
Lecturer on Veterinary Science, Harper Adams College.

THIS is a contagious disease of rabbits and hares caused by an organism known as *Pasteurella tularensis* or *Bacterium tularense*. The disease occurs in nature as a fatal bacteræmia of wild rabbits. Man, monkey, ground squirrel, rabbit, guinea-pig, mouse, woodchuck, opossum, young coyote, pocket gopher, porcupine, chipmunk and grouse are highly susceptible to the disease, whilst rats, cats, sheep and goats are slightly susceptible. Tularæmia was first recognised as a specific disease in 1921 by American workers. The disease has been found in most sections of the United States, in Japan and Russia. It is highly probable that the disease exists in many parts of the world.

P. tularense, the organism which causes this disease, is very small, measuring 0.2 by 0.3 to 0.7 microns, occurring singly. It is non-motile, Gram-negative and

* Paper presented to the Seventh Rabbit Conference, Harper Adams Agricultural College, Newport, Shropshire, August, 1935.

non-sporing. Like other organisms of the Pasteurella group it is extremely pleomorphic, producing bacillary (rod-shaped) coccoidal (circular) and bipolar forms. When grown artificially it is found that special media is necessary for its development: blood agar, dextrose blood agar, dextrose serum agar, with the addition of fresh rabbit spleen to the medium, assists its growth, but the best media are coagulated egg-yolk or blood dextrose-cystic agar. The organism is killed by cooking, and after subjecting it to a temperature of 56° C. to 58° C., disinfectant solutions, such as tricresol 1 per cent. solution, destroy the organisms in two minutes. In pure glycerin the spleen or liver of an infected animal remains alive for many days, and is the preservative used for laboratory inoculations.

Tularæmia has never been found in hutch rabbits, and is primarily a disease of wild rodents, especially rabbits and hares. Transmission from animal to animal is probably carried out by blood-sucking insects and possibly by scratches and bites.

Organisms of the Pasteurella group show very great variation in their virulence and the lesions vary in different animals. In the rabbit the liver shows small yellowish-grey specks throughout the organ. The spleen is enlarged and studded with miliary necrotic granules, sometimes so thickly that large areas are necrosed. The lymphatic glands are frequently enlarged and inflamed. In guinea-pigs the disease closely resembles bubonic plague. A chronic form of this disease has been reported in guinea-pigs with enlargement of the lymph nodes and necrotic areas in other organs which might be mistaken for tuberculosis. It is probable that in the past outbreaks of so-called pseudo-tuberculosis in rabbits have really been cases of tularæmia through infection of domesticated rabbits from wild rabbits.*

Coccidiosis of the Rabbit.

Two forms occur in the rabbit caused by different species of the protozoan parasite, namely, *Eimeria stiedæ*, which causes coccidiosis of the liver and bile duct, and *Eimeria perforans*, which occurs in the intestine of the young rabbit. Frequently both forms are found to exist together in the same animal. Young rabbits up to four months old are particularly subject to the intestinal form, which frequently occurs soon after weaning. The abdomen of the infected rabbit becomes enlarged, scouring follows, with soiling of the fur on the hind quarters, the rabbit refuses food, and is dead in a day or two following the first symptoms.

Post-mortem examination shows very little to the naked eye, the intestines appear moister than normal, and here and there an inflamed portion may be found; on opening this part of the intestines the inner lining appears to be composed of a pink jelly-like material (gelatinous inflammation). When a smear is made from this portion of the bowel and examined by the aid of the microscope, thousands of oocysts are found.

Cleanliness and prevention of overcrowding are important factors in the control of this type of disease. Provided rabbits are being properly fed and

* Hull, 1931: "Diseases of Animals Transmissible to Man."

are cleaned out frequently there is little danger of an epidemic; it is when the management is at fault that outbreaks of this disease occur. When the liver type of the disease occurs it is generally found to attack rabbits of four months of age. This form of the disease is more chronic than the intestinal type.

The symptoms are as follows: the fur or wool loses its glossy appearance, the animal begins to lose flesh, the abdomen becomes pendulous, and finally it becomes pot-bellied. By the time death occurs a considerable amount of fluid may have been secreted in the abdominal cavity and a dropsical condition set up. Post-mortem examination shows white spots in the liver, the tissue of which is harder than normal (cirrhosis); the gall-bladder is often thickened, and the ducts, liver tissue and gall-bladder frequently contain thousands of oocysts. When a microscopical preparation is made upon one of the white spots, thousands of oocysts are found to be present, often packed so closely together that they touch on all sides and lie on top of one another on the microscopical preparation.

Does infected with the chronic type of the disease are often responsible for conveying the disease to their young in hutches and runs. A study of deaths in litters belonging to the same doe often shows that an unusually high number of them to have died, and post-mortem examination of the doe reveals coccidiosis which has been conveyed to her young in the "droppings." Warrens of wild rabbits become heavily infested when the numbers increase and when the season is a suitable one for the development of the coccidia; warm, wet weather in the spring is particularly suitable for the rapid development of coccidia among young rabbits. Following the dry weather we have experienced for the last three seasons there has been a very marked increase in the population of wild rabbits. This evidence supports the opinion that coccidiosis is the chief cause of mortality in wild rabbits, and it is found to be the commonest cause of death in the domestic rabbit.

Control measures depend upon keeping the rabbits from contact with their droppings by frequent cleaning of the hutches and runs and upon keeping the animal's resistance to the disease up by good feeding, allowing plenty of fresh air and avoidance of over-crowding.

Some Parasitic Worms of the Rabbit.

Tremotodes (leaf-like worms or flukes). *Dicrocœlium dendriticum* (*D. lanceolatum, D. lanceatum*). This organism occurs in the bile ducts of the hare and rabbit, and of sheep, oxen, goats, pigs, donkeys, dogs and occasionally man. When present in sufficient numbers it may produce cirrhosis of the liver, like the common liver fluke of sheep and cattle, *Fasciola hepatica*. In size the worm is about 4 to 9 mm. long, 1.5 to 2.5 mm. wide. In Europe the intermediate host is possibly a fresh-water snail (*Planorbus marginatus* or *P. complanatus*) or a slug (*Arion* or *Limax* sp.), but the life-history has not been elucidated. Species of Fasciola have also been recorded from the rabbit.

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Nematodes.

Strongyloides papillosus.—The infectious larvæ of these worms go through a course of migration within the body of the rabbit after they have penetrated the skin of the animal, and finally settle down in the alimentary canal. The eggs reach the infective stage after lying in the open for some weeks; during this period they are very resistant to climatic conditions and to chemical substances, and they remain alive and infective for several years. After gaining an entrance into the body of the rabbit they are carried in the blood-stream of the portal system, from there to the liver, and from the liver they may go to the lungs; when they grow and moult in the lungs they rupture the capillaries, escape into the alveoli and finally, by way of the bronchi and trachea, reach the mouth and are swallowed. The last moult takes place after the young worms reach the intestines, where they rapidly develop to maturity.

Nematodirus spathiger (Raillet, 1896).—This is a round worm belonging to the Tricostrongylidæ and causes inflammation of the inner lining of the intestines in rabbits. When the eggs of this worm are passed they are harmless, but after a few days under suitable conditions they become infective. After the embryos have moulted twice, the cuticle is not shed after the second moult, but remains as a protective sheath. If at this stage they are swallowed by the rabbit or come in contact with its skin, they penetrate the mucous membrane or skin and find their way into lymphatic vessels or veins. After migration through the organs of the body they are carried to the intestine and reach maturity, after again moulting twice and becoming sexually mature. In the intestine they lay eggs which are passed out with the droppings and the life cycle is continued. These worms cause enteritis (inflammation of the inner lining of the intestines), and are frequently a cause of death.

OX WARBLE FLIES.*

By R. STEWART MACDOUGALL, M.A., D.Sc., LL.D.

Member of the Board of Examiners of the Royal College of Veterinary Surgeons.

THE warble flies, from their hairiness and colour, look more or less like humble bees. Two species are enemies of cattle in Scotland, *viz.*, *Hypoderma lineatum* and *Hypoderma bovis*, while a third species, *Hypoderma diana*, is an enemy of the Red Deer. The Deer warble fly is mentioned here because of the belief in various parts of Scotland that it may also infest cattle, and cause, as larvæ, swellings or warbles under the skin of cattle and so help to spoil hides. There is no proof of this. The Deer warble fly has, however, an economic importance of its own, as its larvæ or maggots spoil the deer hides for glove-making and other purposes.

In Scotland cattle are the hosts of the two warble flies, all breeds being attacked, including Highland cattle. In America the bison may be a host animal,

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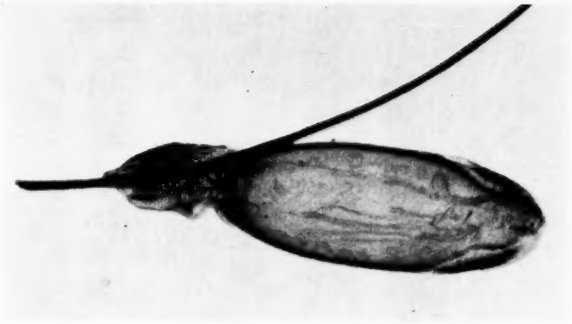

FIG. 1.—Egg of *Hypoderma bovis*. From nature, greatly magnified.

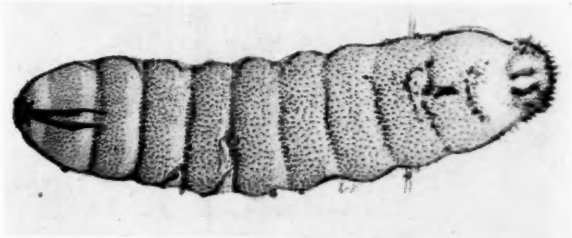

FIG. 3.—First-stage larva of *Hypoderma bovis*. From nature, greatly magnified.

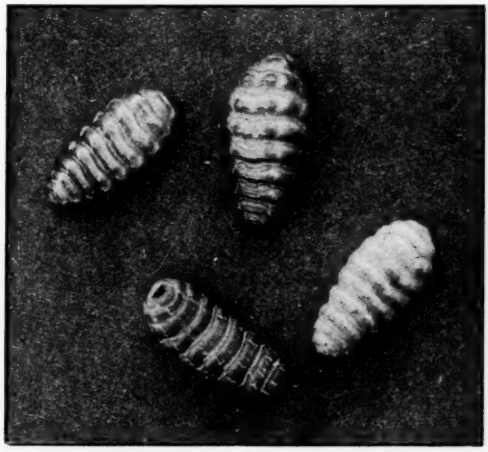

FIG. 4.—Full-grown larva of *Hypoderma bovis*. From nature.

(*Article by* R. Stewart MacDougall, M.A., D.Sc., LL.D., *page* 472)

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and in India larvæ of *H. lineatum* have been found parasitic on the goat ; but the normal warble fly of the goat in India is *Hypoderma crossii*.

H. bovis measures just over half an inch in length, while *H. lineatum* is a little smaller ; in *H. lineatum* there are four conspicuous dark lines down the middle region of the upper part of the thorax or fore-body, while in *H. bovis* a tuft of yellow hairs on this fore-body region hides the dark lines.

The ox warble flies are harmful to cattle in two of their stages. The winged flies terrify cattle and cause them to gad ; while their larvæ interfere with the health of the animals, and in their later stages, in swellings under the skin of the back, spoil and may ruin the hide.

Characteristics and Habits of the Flies.—They love sunshine. *H. lineatum*, which appears in summer a month earlier than *H. bovis*, is, not, however, so dependent on sunshine. They fly well. Not enough is known concerning the distances warble flies can cover in flight, but there is a record of nine miles. A warble fly cannot bite or sting, but an instinctive dread is induced in cattle by the come-and-go of the egg-laying female and by the hum—not loud, but low, and sufficiently audible to make Bishopp write of the " listening attitude " of the cattle when the fly is near. Sensitiveness is increased when the minute larvæ from the fly's eggs are boring into the skin. Hadwen repeatedly observed how the flies—*H. bovis* especially—by their persistency worried and disheartened the beasts. The flies do not suck blood ; they cannot wound ; they do not feed ; the nourishment necessary for the development of the eggs is obtained from the store of reserve laid up by the larvæ or maggots, which in the course of their life feed in the body of the animal and under the skin of the back. The adult fly is short-lived.

Life History.—The life-cycle is an annual one, a single generation in the year. Most of the year is passed in the larval or maggot condition, the earlier stages for months internally and out of view in the tissues of the host animal, and the later larval stages in swellings under the skin of the back. The earliest adults of *H. lineatum* issue from their pupal-cases in the soil in the first days of summer, those of *H. bovis* later on. After pairing, the female, by extending her ovipositor or egg-laying tube, lays her eggs chiefly on the hairs of the legs, low down ; *H. lineatum* is known as the heel-fly because of this. A female in the course of her life may lay 600 to 800 eggs.

The egg, dull-white in colour with a smooth shell, is provided with a grooved appendage or stalk which fits over the hair (Fig. 1), attachment being aided by a sticky secretion. *H. lineatum* lays several eggs on the same hair, *H. bovis* only one egg to a hair and well down. While the legs are favourite places for the laying of eggs, a number of other places on the body may be used (Fig. 2). The running animal may be followed up by the fly seeking to lay her eggs, or, as happens with *H. lineatum*, the fly may land on the ground near a recumbent animal, back towards the animal, and then attach the eggs to conveniently reached hairs by means of her extended ovipositor. By a week the tiny larva has hatched

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out and, making its way to the base of the hair, pierces the skin and begins its wandering in the tissues. The newly hatched larva (Fig. 3) is spiny and has cutting mouth hooks. From the place of entry the migrating larva makes its way, by the aid of a digestive ferment, to the back, spending on the way a considerable time in the gullet. In the early part of the year as many as thirty-four larvæ of *H. lineatum* have been taken from a single gullet. The road by which *H. bovis* travels is still a secret to be extorted from nature. From the gullet

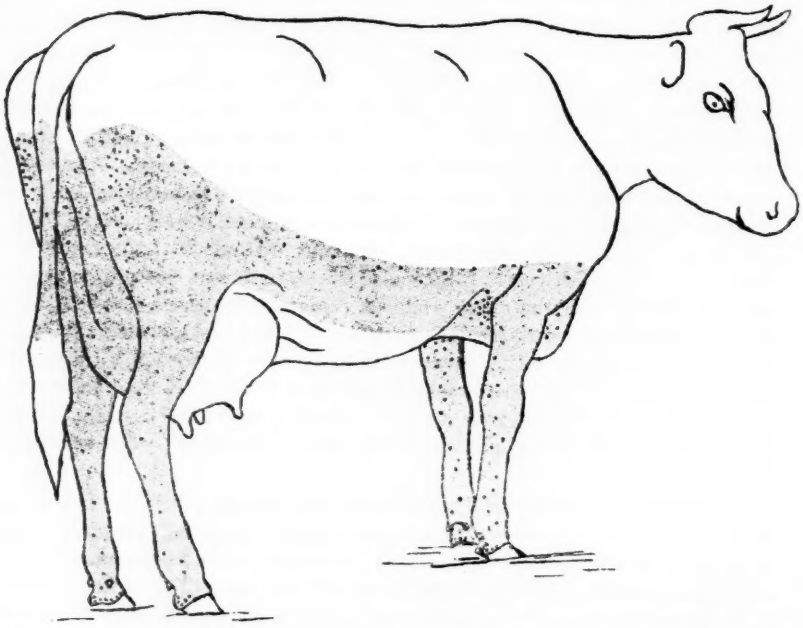

FIG. 2.—This is a drawing from a figure by Dr. Seymour Hadwen. The black spots or dots indicate the places where most eggs have been found; the shaded parts indicate the whole area where eggs may be deposited. The figure is for both species of warble fly.

the larvæ pass to the back. A hole, which is gradually enlarged, is made through the skin to the outside. Before the skin is perforated the presence of the larva is indicated by a small sensitive swelling, in the centre of which is a red dot or "blood spot." The larva, in its last stages under the skin, ceases to move about, becomes altered in shape and colour, and attains the form so well known to the farmer (Fig. 4). The tissues of the host animal react to the presence of these sedentary larvæ and a cyst is formed round the larva (Fig. 5). In this chamber or cyst the larva completes its growth, feeding now on pus resulting from the inflammatory secretion due to its muscular movements and also to organisms that may have entered from the outside. The larva lies in the cyst horizontally with the

hard hind spiracles or breathing organs applied to the hole in the skin for the intake of air. During migration from the place of entry in the skin to the back the larva takes the line of least resistance, *viz.*, the softer connective tissues. The path from gullet to back is more or less direct, by the diaphragm, or ribs, or by way of the spinal canal.

The great majority of the warbles are found in the region along the back, from just behind the shoulder to the hook-bone, in two strips, eight or nine inches broad. These strips begin from two to three inches on each side of the middle line of the back or backbone and extend laterally for seven to eight inches. This is the region where the larvæ, naturally, are most likely to escape crushing. Some warbles, however, are found behind the hook-bones, on the rump, and down the flanks, and others in front of the shoulders. In cows or cattle in good condition one may find warbles well down the ribs on each side, and they occasionally occur right in the middle line above the spinal cord.

The full-grown larva, with tough outer covering and bands of spines, presses itself out of the opening in the skin—an act requiring considerable muscular effort —and drops to the ground, where it takes cover from the light under litter or in the surface layers of the soil. In such a shelter-place the larva, after a short quiescent stage, moults. The moulted skin, becoming hard and black, remains as a protecting case or puparium, under cover of which the fly develops. When ready, in five or six weeks, the fly comes from the puparium and appears in the open. The wings slowly expand, the other parts dry and harden. The fly may mate the same day. Fig. 6 gives in graphic form the life cycle, and Fig. 7 is a calendar from the year's round of *H. lineatum*.

The larvæ of both *H. lineatum* and *H. bovis* are common in Scotland from north to south, and this is not to be wondered at, because of the purchase and introduction of animals from different parts of the country. While the *H. lineatum* fly appears earlier than that of *H. bovis*, the flight periods of the two flies overlap and there is some variation of these periods.

Harm and Loss due to Warble Flies.—There is loss of condition due to animals gadding. The quality and quantity of milk is affected by excitement and over-exertion. Some pain is attendant on the boring into the skin of newly hatched larvæ. Condition suffers from the presence of a number of larvæ in the sub-dermal tissues. Tenderness of back is attested by the way in which the animals resent interference when the number of warbles is large. The entry to the swelling of bacteria from the outside sets up abscesses that mean unthriftiness.

The seller loses by the absence of competition in the sale ring when an animal is noticeably warbled. There is great loss in the case of warbled hides; this may amount to 6*s*. or more in the case of a heavy hide. There is loss due to the spoiling of hides for tanning purposes (Fig. 8). Even when holes made by warble-fly larvæ have had time to heal after the escape of the larva, the leather made from a hide so affected shows pitting or spotting, easily recognisable, and it cannot be used for the finest work. A markedly lower price is paid for such leather

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and there are drawbacks to its use, for example, for belting, where it breaks at a lower strain, or for shoemaking, where the soles are not so waterproof.

There is serious loss to the butcher from what is known as " licked beef," due to wastage in dressing the carcase of a warbled animal. Where warble larvæ have been present, the back, on removal of the hide, shows a mass of straw-coloured jelly-like matter, known as " butcher's jelly." When this has been

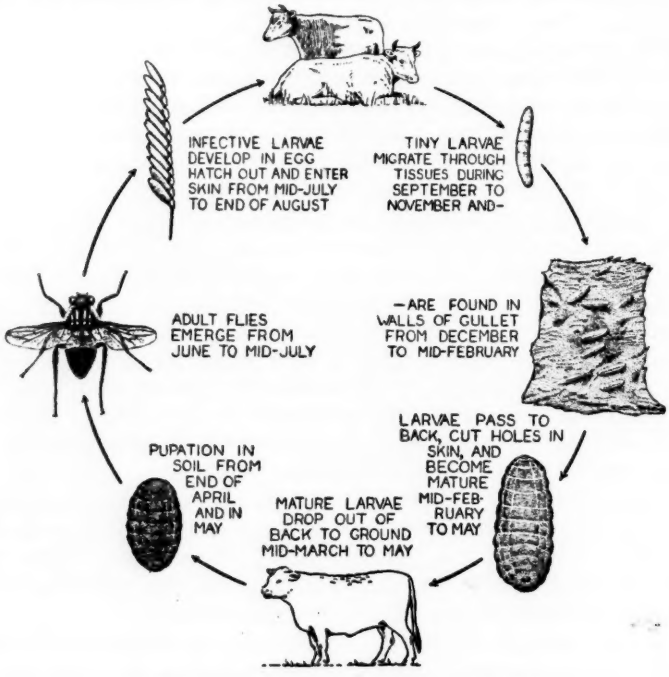
INFECTIVE LARVAE DEVELOP IN EGG HATCH OUT AND ENTER SKIN FROM MID-JULY TO END OF AUGUST
TINY LARVAE MIGRATE THROUGH TISSUES DURING SEPTEMBER TO NOVEMBER AND-
-ARE FOUND IN WALLS OF GULLET FROM DECEMBER TO MID-FEBRUARY
LARVAE PASS TO BACK, CUT HOLES IN SKIN, AND BECOME MATURE MID-FEBRUARY TO MAY
MATURE LARVAE DROP OUT OF BACK TO GROUND MID-MARCH TO MAY
PUPATION IN SOIL FROM END OF APRIL AND IN MAY
ADULT FLIES EMERGE FROM JUNE TO MID-JULY

FIG. 6.—Life cycle of *Hypoderma lineatum*.

scraped away the back of the sirloin is left almost bare and its value is greatly reduced. Such beef is very difficult to mature, and it displeases the eye of the customer owing to its greenish tinge. An authority has estimated that the loss thus caused may amount to a halfpenny a pound over the whole carcase.

Control.

Shelter.—Cattle attacked by warble flies seek shade. It has been found that protection and relief have been obtained where it was possible to give harassed animals access to barns or sheds. Further, the flies will not follow cattle over water.

Repellents.—Experiments have been carried out at home and abroad with a large number of oils and emulsions as dressings whose odour or nature would

disgust the fly or prevent her from laying her eggs. Both in England and Scotland such tests were made on behalf of the Departmental Committee on the Warble Fly Pest.* Nothing practicable can, however, be recommended as a result of these investigations. A considerable amount of experimental work has been done in America in the endeavour to secure a machine or sprayer which would effectively apply a spray or wash to animals for the purpose of killing or repelling flies.

DECEMBER
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
LARVAE NOW FOUND IN WALLS OF GULLET AND LATER THEY MOVE TOWARDS BACK
LARVAE REACH BACK MAKE HOLES THROUGH SKIN TO OUTSIDE SWELLINGS SMALL AT FIRST BUT THEM-SELVES INCREASING IN SIZE. LARVAE STATIONARY IN MARBLES OR CYSTS
EARLIEST MATURE LARVAE PRESS OUT & FALL AWAY
A SUCCESSION OF MATURE LARVAE FALLING AWAY
LATEST LARVAE MATURING. THE FULL-GROWN LARVAE NOW PUPATE UNDER COVER OF LITTER IN SOIL
ADULT FLIES EMERGE PAIR AND LAY THEIR EGGS ON CATTLE
EGGS HATCH AND THE TINY LARVAE CUT DIRECTLY INTO THE SKIN GIVING RISE TO SENSITIVE AREAS THAT SHOW FOR A SHORT TIME AS SMALL PIMPLES AND SCABS
LARVAE CONTINUE THEIR BORING AND MIGRATE THROUGH THE TISSUES TO CHEST AND ABDOMINAL MUSCLES

FIG. 7.—Calendar of the round of the year, for *Hypoderma lineatum*.

Experiments have also been made, chiefly in the United States, in which, during the egg-laying season of the flies, cattle have been made to pass repeatedly at regular intervals through wading vats containing arsenical or creosote preparations. The purpose was to reduce the percentage of eggs laid and to kill the newly-hatched larvæ. Nothing practically useful can, however, be declared.

Removal of the Larvæ.—Squeezing out the larvæ as they lie in their last stage in the swellings on the back is an excellent annihilative measure. There are instances where in isolated areas this method has resulted in complete eradication of the pest. The squeezing out is done by means of the thumb and forefinger

* Report of the Departmental Committee on Warble Fly Pest, 1926 (H.M.S.O.).

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of both hands. The work, though tedious, is not difficult with animals that have loose, slack or elastic skins and are restful, but is more difficult with other conditions of hide and with restless animals. A special hand suction-pump has had some success in the removal of larvæ from the warbles.

Destruction of Larvæ by Dressing.—The larvæ in the back may be dressed with some substance which will kill them and so prevent a new generation of flies and a fresh laying of eggs. Such a dressing, to be practicable, must kill a very high proportion of the treated larvæ, must be easy to prepare and to apply, must be harmless to the animal treated and to the worker on repeated use, and must be cheap. Both at home and abroad hundreds of different substances for dressing the larvæ have been tested in experiment. The Departmental Committee referred to had considerable success with tobacco powder and lime, with nicotine, sulphate and lime, and with a Derris preparation.* The work with Derris was pioneer work. With 1 oz. of Derris powder to a quart of water, 378 warble larvæ were killed out of 440, *i.e.* 85 per cent., and with 1 oz. of Derris powder to a pint of water 581 larvæ were killed out of 614, *i.e.* 94 per cent. Bishopp and his colleagues in the United States thoroughly tested and proved the value of Derris extracts in many experiments, and very successful results were obtained by Mr. R. C. Gant in experiments against warble fly larvæ in Worcestershire in 1928 and 1929. Still later, very extensive experiments in England and Scotland, under the auspices of the Leathersellers' Company's Warble Fly Committee and the Highland and Agricultural Society of Scotland, proved beyond all doubt that in trustworthy Derris preparations the farmer had to hand a highly satisfactory treatment against warble fly larvæ in their cysts or swellings.

In the course of experiments carried out in nearly every county in Scotland, in which many thousands of warble fly larvæ were dressed and a little later examined for results, the most successful treatment was with Polvo Powder Soap Wash.† The formula for this dressing is:

Derris powder	1 lb.
Soft soap	¼ lb.
Water	1 gallon

The method of preparation is as follows: Dissolve the soft soap in a quart of boiling water and allow to cool. It is important that the cooling be to blood heat at any rate, for if the soap solution be used too hot when poured on to the Polvo powder (*i.e.*, the Derris powder), the active insecticidal principle of the Derris may be adversely affected. Place the Polvo powder in a bucket, pour the cool soft-soap solution over it and stir thoroughly, bringing the quantity gradually up to a gallon by the addition of cold water. Use the dressing freshly made, and while using keep the fluid agitated so that the Polvo powder may remain in suspension.

The worker feels with his fingers for the lumps or swellings, not all of which

* See Note on page 477 and *Scot. Journ. Agri.*, vol. vii, p. 61 (Jan. 1924).
† This is a proprietary preparation.

are plainly visible, and then, pulling aside any matted hair and clearing away the scab which so often clogs entry to the larvæ, applies the dressing. The dressing may be applied with a stout syringe, the nozzle of which is just large enough to gain entry to the hole leading into the cyst where the larva lies. The syringe must be a stout one and not a delicate hypodermic syringe. In some cases the workers used successfully a motor-cycle grease gun of the pump type, having a nozzle about 3/16th inch in size. The syringe method is an accurate way of ensuring the entry to the cyst of the dressing fluid, but almost as good results attended the use of a cloth. The cloth is first dipped in the liquid dressing and then pressed hard on the hide over the hole in the skin, a slight rotatory or spiral movement being given at the same time. The rotatory movement exposes the warble hole by removing any block or scab resulting from matted hair or dried exudate that may have formed over the entrance hole. Pressure on the cloth causes the dressing to gain entry. The larvæ killed by the dressing will, for the most part, be later expelled by the animal or absorbed.

As explained earlier, and as a glance at the Calendar (Fig. 7) will show, warble fly larvæ reach maturity over a period of some months, so that examination for dressing on any one day may reveal differences in size of hole corresponding to the stage of development of the underlying maggot. The hole gradually increases in size. At one time of dressing some holes may be too small to justify treatment, whereas the same hole ten days later may be quite conspicuous.

Number of Times for Dressings.—In any campaign against warble-fly larvæ the number of times of dressing is a matter of great importance. The Departmental Committee recommended four dressings against the larvæ in their warbles or cysts. The experience of the Highland and Agricultural Society's Committee and of the Leathersellers' Company's Committee supports this view. To make sure, however, of the destruction of the very earliest ripe larvæ five dressings might be safer. Unfortunately there are two flies, those of *H. lineatum* being earlier and those of *H. bovis* later, and this extends the period in which one may expect to find larvæ. In various parts of Scotland warbles can be very noticeable by the end of February, and there are records from the South of Scotland of mature larvæ falling away in the third week of March. It would be wise to undertake the first dressing in the third week of March, followed by three other dressings at intervals of about a month.

One can scarcely expect a more efficient and cheap dressing than that described above, but it would be an advantage if a Derris dressing or wash equally reliable and efficient were available requiring only dilution before use and forming a lather on rubbing, so that individual treatment of each warble would not be necessary. In the experiments carried out in Scotland a warble-fly powder, in which the Derris was already incorporated with the soap and only water was needed before use, seemed promising. The dressing lathered up freely on rubbing, the workers liked it, and it gave the hide rather a fresh appearance. Unfortunately

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the results were unequal. In the United States and on the Continent of Europe many successful experiments have been made with Derris preparations.

"Derris," an extract from the roots of certain East Indian plants, contains several insecticidal principles, the most valuable of which is rotenone. Derris as an insecticide is of proved value, not only against a number of animal parasites, but also against insects injurious to plants.

Ointments to kill the Larvæ.—Derris ointment, or iodoform, or pyrethrum, with vaseline or some kind of oil, have been used successfully to destroy larvæ as they lie in the cysts with their breathing pores near or pressed against the hole in the skin. The ointment plugs the larval spiracles and suffocation follows. An ointment, compared with other dressings, has a somewhat limited use. If used later in the season when long hairs have been shed and time can be spared for the thoroughness necessary for success, good results can be obtained. An ointment with the formula 1 oz. iodoform to five of vaseline, as used in the United States, is successful in killing the warble larvæ, but the odour is such that when the ointment is applied to cows in milk there is a great risk of the milk being tainted.

Compulsory Legislation.

It is safe to say that while from time to time there has been sporadic interest and even a certain amount of agitation regarding the warble fly pest, the interest in this country has never been greater or so general than at present. The butcher, the hide merchant, the leather-seller and the tanner have long had a proved case. It is hard that the tanner should have to go to Scandinavia to buy hides because the home ones are warbled. The farmer holds, as he has always held, the key to the solution of the problem. So far he is not apparently convinced that he bears a considerable share of the loss due to warble flies. Opinion has, however, been changing and there is now a considerable amount of support for the proposal of some form of administrative action. Compulsion is an unpleasant word, and legislation by which a farmer would be compelled to treat his cattle for warble —as by law is the case in Denmark, Germany, Sweden and Russia—would seem hard to many farmers and stockowners in these difficult times, yet the long view may be the wise one. Examination and treatment of cattle would certainly be onerous for two or three years, but it would become less burdensome with the progressive reduction, and in some cases the annihilation, of the pest.

In July, 1934, at a meeting of the Regulations Sub-Committee of the Leather-sellers' Company's Committee, the following resolutions were drawn up for transmission to the Ministry of Agriculture :

(1) In view of the consensus of opinion of all interested parties that it is urgently desirable that the universal dressing of cattle against the warble fly pest should be undertaken, and that suitable action should also be taken to deal with imported cattle, the Leathersellers' Company's Warble Fly Committee, representative of all parties concerned, urges that the Minister of Agriculture should without delay consider the administrative problems involved and the means to overcome them.

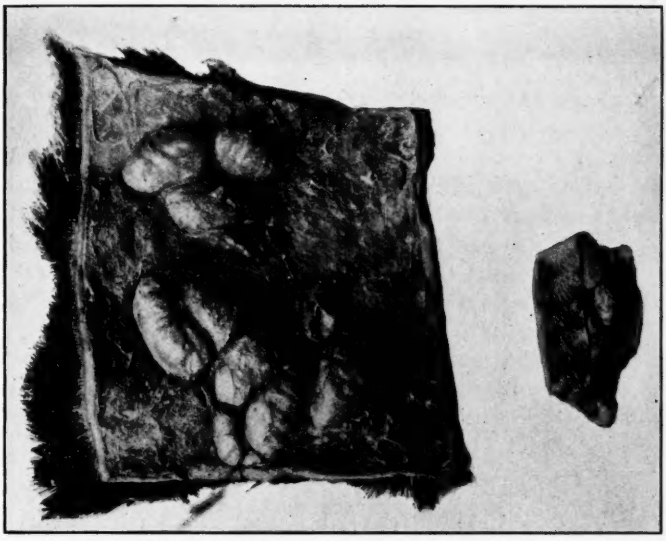

FIG. 5.—Inner side of hide of ox showing larval cysts; in each is a larva of *Hypoderma bovis*. In the smaller figure a cyst has been opened to expose the larva. From nature, reduced.

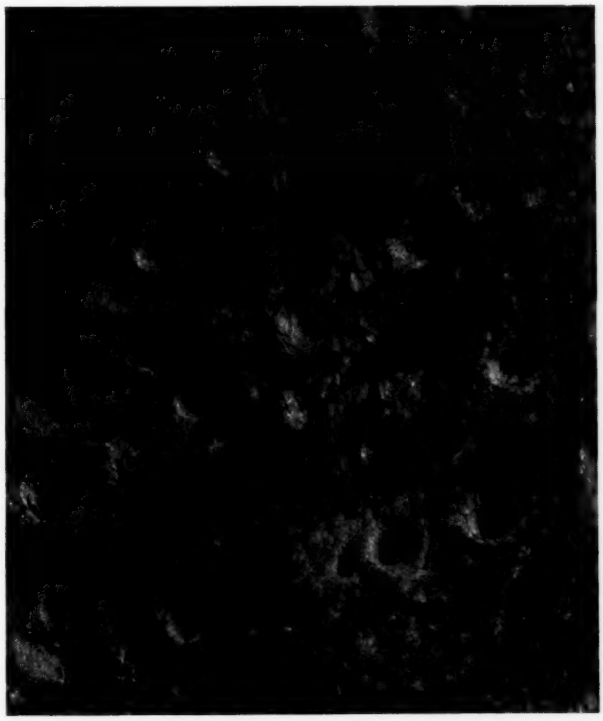

FIG. 8.—A small portion of leather from a badly marked hide. Natural size.

(*Article by* R. Stewart MacDougall, M.A., D.Sc., LL.D., *page* 472)

(2) The Committee further strongly urges that in any long-term scheme for the reorganisation of the cattle industry in this country the opportunity should be taken to deal in a comprehensive manner with the warble fly problem. In the opinion of the Committee no reorganisation of the cattle industry would be satisfactory which did not put into operation machinery which would lead to the ultimate elimination of the pest from this country.

The following are some of the difficulties in the way :

(1) It is not easy to prove to the farmer that the presence of a small number of larvæ affects the production of beef or milk. The animal with a small number of warbles gives no evident sign of discomfort. The few of to-day may, however, be the many of to-morrow. Besides, the presence of only four warbles reduces a first-class hide to a lower category, with consequent money loss ; with over four warbles the hide is placed in the second class.

(2) The treatment has to be undertaken at a busy season of the year. From mid-March to the end of May all arable farmers are busy with sowing and planting, and extra long hours are being worked. Some would find it difficult to give precedence to warble-dressing. Admittedly the work of dressing would be onerous at the beginning, but if the treatment were general it would become light and easy in time. To ensure this it would need to be general.

(3) It is naturally disheartening to keep treating bought animals that have become warble-infested elsewhere.

(4) The dressing of store cattle is sometimes out of favour, as this involves disturbing the fattening animals when it is desirable that there should be as little excitement as possible. There would be little difficulty with dairy cattle, which are accustomed to being handled and collected, or with special herds. But in many parts of Scotland, where cattle are put out from May to October, it would be difficult to ensure the thoroughness of a third or fourth collection for the purpose of examining and dressing them.

The figures are from Dr. Stewart MacDougall's " Report to the Highland and Agricultural Society of Scotland," and are reproduced by the courtesy of the Society.

HYDATID DISEASE—A GENERAL SURVEY. *

By HAROLD R. DEW, F.R.C.S.

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Life History.

THIS disease is due to the development in the human subject of the cystic or larval stage of the *Echinococcus granulosus* (Batsch), a small cestode whose natural habitat is the small intestine of the dog. The adult worm measures up to 6 mm.

* Reprinted, by kind permission, from *The Medical Press and Circular*, August 7th, 1935.

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in length and possesses three or four segments, the terminal one of which carries from 500 to 800 ova in various stages of development. These worms may be present in thousands in an infested dog, and the intact or disintegrated mature segments are shed in the fæces.

The ova, approximately 45μ in length, are, like those of the other cestodes, surrounded by a chitinous envelope, and are extremely resistant to exposure. Under favourable ætiological conditions they may be ingested by the correct intermediate host in which the cystic stage of development takes place.

Ætiology and Prophylaxis.

Although the worm has been rarely found in other canines, owing to his cosmopolitan distribution and close association with the man the dog is practically the only source of infestation. This animal is infested by eating fertile hydatid cysts in the viscera of animals which can act as intermediate hosts, nearly always the domesticated sheep, ox or pig. It is found that the incidence of the disease in man follows accurately that in the domestic animals of the country. For this reason the disease is common in Iceland, Australasia, Algeria and South America.

Man acts only as an intermediate host, occupying the same biological position as the sheep, but owing to the fact that dogs do not have access to human viscera, such infestation must be regarded as a dead end as regards completion of the parasitic life cycle. In the past, great importance has been attached to the contamination of water or fresh vegetables as an ætiological factor, but there is no doubt that contamination of the hands by direct contact, *i.e.*, by handling and caressing dogs, is far more important. This explains the relatively high incidence in various occupations, the frequency of more than one case in a family, the almost equal incidence in the two sexes, and the frequency of infestation during childhood, the age of promiscuity with the dog and unhygienic behaviour generally. One must realise that the majority of infestations occur in childhood, although, owing to the slow growth of the cyst, the disease often does not manifest itself until adult life. It may be taken as a general rule that an hydatid cyst in man is nearly as old as the patient harbouring it.

Owing to the existence of two distinct evolutionary cycles in the life of the parasite, prophylactic measures are easy, and should be applied in two ways: Firstly, by preventing infestation of the dog by controlling his access to infested viscera; and, secondly, by educating people concerning the danger of contact with possibly infested dogs.

Geographical Distribution.

Although hydatid disease has been recorded in all countries, it occurs most commonly in those countries in which sheep are pastured in large numbers, these animals acting as ideal intermediate hosts. It is thus relatively common in Iceland, Australia, New Zealand, South Africa, Algeria, and South America. Smaller foci occur in France, Dalmatia, the Balkans, Italy and Russia, while sporadic cases appear in practically all countries.

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It is rare in North America, although many sheep are pastured there. It would seem that in this country, as elsewhere, provided a close association of dogs, sheep and man remains, the incidence of this disease will gradually increase.

Development of the Cyst.

Following ingestion by the intermediate host the ovum hatches in the upper alimentary canal, liberating an active six-hooked embryo, which bores through the wall of the gut and, entering a radical of the portal vein, is carried to the liver where in the majority of cases it comes to rest, and where its typical further development is seen. At first there is an active cellular reaction on the part of the host defences—mononuclear and eosinophil cells surrounding the parasite within a few hours. There is no doubt that this reaction sometimes overwhelms the parasite, which then undergoes disintegration and phagocytosis. In favourable cases, however, it grows rapidly, and with the same dramatic change that characterises all embryonic growth, so that at the end of three weeks it shows vacuolation, with the elaboration of specific fluid and a protective outer wall.

As the parasite grows the cellular reaction to the host dies down, probably co-incident with the development of the semi-permeable laminated parasitic cuticle, and so the cessation of leakage of specific protein. The leucocytes which surround the follicle become gradually converted into fibroblasts, and toleration of the parasite by the host is established. At the end of three months the cyst is nearly a centimetre in diameter, while at the end of a year a cyst approximately 5 centimetres in diameter, surrounded by a tough avascular adventitia, is present.

The fully developed cyst consists of a double-layered parasitic wall composed of an outer laminated membrane and an inner cellular germinal layer surrounding specific hydatid fluid.

The laminated layer is composed of laminæ of hyalin which are laid down from within out by the nucleated germinal membrane which lines its inner aspect. It is very elastic, tends to turn inside out when torn, and serves to act as a support for the cyst, to retain the specific fluid at a fairly high tension, and to protect the cyst from the entry of noxious substance. The specific hydatid fluid is also elaborated by the germinal membrane, and normally is clear, containing little or no protein, but up to 0.2 per cent. sodium chloride. It acts as a buffer and nutritive medium for the developing scolices.

The scolices or future worm-heads are only found in mature cysts, and are a sign of completed biological development. They are produced inside brood capsules from the germinal membrane, and may be present in thousands in a single cyst, a fact which gives some idea of the prodigality of nature where reproduction is concerned. They are just visible to the naked eye (measuring up to 160μ in the resting state) and are seen in all stages of development from the undifferentiated cellular bud to the fully developed scolex with suckers, hooklets and contractile tissue. When swallowed by the dog they become active and rapidly develop into adult worms, and so the life cycle is completed.

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Frequently in man, and occasionally in other animals, daughter cyst formation is noticed. This, in its typical endogenous form, consists of the development within the confines of the original mother cyst of numerous replicas of the primary cyst. There has been much controversy as to the reason for this development, but probably it should be regarded as due to some interference with the integrity of the original cyst, *i.e.*, that it is a protective phenomenon, the germinal elements being stimulated by adverse conditions to elaborate a second protective cuticle in order that the development of the reproductive elements may go on.

Clinico-Pathological Considerations.

In man the majority of cysts are found in the liver, this organ acting, as it were, as a filter; but sometimes the parasite passes the hepatic capillaries and enters the pulmonary circulation, the lungs being the next most common site. The parasites may even pass the pulmonary capillaries and make their way to any part of the body, and the lessening proportionate incidence as the periphery of the body is reached indicates that distribution by the blood stream is the only rational explanation. The following table gives the commonly accepted figures for primary cysts :

DISTRIBUTION OF PRIMARY HYDATID CYSTS.

Liver	76.6
Lung	9.4
Muscular and subcutaneous tissue ...	5.2
Kidney	2.3
Spleen	2.1
Bones	0.9
Orbit	0.7
Brain	0.6
Other sites	2.2

Multiple infestations are more common in the human subject than is usually realised ; more than one cyst being present in at least 60 per cent. of cases.

Clinical Aspects of the Simple Cyst.

These simple cysts are typically found in children and young adults, and their outstanding characteristic is their latency. They may exert pressure on any structure, and since practically any organ may be involved, bizarre and protean manifestations are often produced. Small cysts in special situations such as the orbit, the cranial cavity or the spinal canal may, of course, produce grave symptoms relatively early. Deformity may be produced, especially in children, but it is remarkable what large cysts can be tolerated. This is not surprising when one considers the frequency of infestation during the growing period, the extremely slow growth of the cyst which enables compensatory changes to occur, and that cysts are shut off from the body fluids of the host by a relatively impermeable fibrous adventitia.

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Ultimately, however, complications occur, their frequency increasing as age advances, and the cyst increases in size. They are relatively rare in young subjects, manifesting themselves usually between twenty-five and forty years of age. Practically all complications depend on an escape of fluid from the cyst, this varying from a slight leak, often masked by other symptoms, to a frank rupture.

Rupture of the Cyst.

As the cyst enlarges it may encroach on a natural channel, a hollow viscus or serous cavity; one area of the laminated membrane thus becoming relatively unsupported. As a result it gives way spontaneously, even during sleep, following muscular movement, coughing or straining, or more commonly following direct trauma, such as a blow, a fall, a crush or a perforating injury. Owing to its peculiar grain, the tear in the laminated membrane rapidly enlarges and allows the escape of the contained fluid and hydatid elements. Such rupture takes place commonly into the subcutaneous or muscular tissues, the bile-ducts, bronchi, alimentary canal or urinary tract; into a serous cavity such as the peritoneum, pleura or pericardium; or into the chambers of the heart or large veins.

Each of these has its own characteristics, and as some of them may be combined in the individual case, a complete discussion is outside the scope of this review. The sequelæ may be grouped together in the following way:

(1) General: applicable to practically all types: (*a*) immediate, hydatid anaphylaxis; (*b*) delayed, secondary echinococcosis. (2) Special: applicable to cases of rupture into a natural channel: (*a*) immediate, mechanical effects; (*b*) delayed, death of the cyst with or without suppuration.

Hydatid Anaphylaxis.

Many clinicians have noted the appearance of peculiar toxic manifestations following puncture or rupture of hydatid cysts. Although these are usually cutaneous, many other symptoms may occur, and there is no doubt that these are mainly anaphylactic due to the sudden absorption of specific protein in a sensitised patient. Clinically, whenever vague symptoms arise during the course of hydatid disease, the question of whether or not they are anaphylactic in nature should always be considered. The following table gives some idea of their protean nature and illustrates some of the risks of indiscriminate puncture of an hydatid cyst.

Secondary Echinococcosis.

Rupture of an hydatid cyst or puncture by a trocar, with evacuation of the specific fluid, does not necessarily cause death of the parasite; this probably rarely occurs unless infection takes place. The parasitic elements have such powers of persistence that if aseptic conditions pertain they can survive and ultimately develop into new cysts, often at a distance from the original—this phenomenon being described as secondary echinococcosis.

At first, clinicians and pathologists regarded all cases of multiple cysts as due

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Anaphylactic Symptoms in Twenty Cases of Hydatid Disease.

Site of cyst	Complication	Casoni Test	Dyspnœa	Cough	Cyanosis	Cardiac	Agitation	Pyrexia	Urticaria	Pruritus	Vomiting	Delirium	Pulmonary œdema	Dilated pupils	Death	Remarks
Liver ...	Bile-duct rupture ...	?	+	+	+	+	+	+D	+D	+	+	—	—	+	—	Three attacks
Heart ...	Rupture	?	+	+	+	+	—	—	—	—	—	+	+	+	+	
Lung ...	Cardiac rupture ...	?	+	+	+	+	—	—	—	+	—	—	+	+	+	
Spine ...	Rupture of D. cysts ...	+	—	+	—	+	—	+	+	+	—	—	—	—	—	Repeated post-operative
Liver ...	Bile-duct rupture ...	+	+	+	+	+	+	+	—	+	+	—	—	—	—	Many previous operations
Liver ...	Bronchial rupture ...	+	+	—	—	—	—	—	+	+	—	—	—	—	—	In convalescence
Liver ...	Casoni test	+	+	+	+	+	+	+D	—	—	+	+	+	+	—	Very small dose
Lung ...	Rupture into P. artery	?	+	+	+	+	—	—	—	+	—	—	—	+	+	
Liver ...	Peritoneal rupture ...	?	+	+	—	+	+	—	+D	—	—	—	—	+	—	
Liver ...	Pleural rupture ...	?	+	—	—	+	+	+D	—	+	+	—	—	—	—	Post-operative
Liver ...	Biliary rupture ...	?	+	—	—	+	—	+	+	+	+	—	—	+	—	
Liver ...	Pleural rupture ...	?	+	+	+	—	+	+	+D	+	—	—	+	—	—	Post-operative
Liver ...	Bile-duct rupture ...	?	—	—	—	—	+	+	+	+	+	—	—	—	—	
Lung ...	Pneumothorax ...	?	+	+	+	+	+	+D	+D	+	—	—	+	—	—	
Omentum	Rupture	?	+	—	+	+	+	+	+	—	+	—	—	—	—	Many previous operations
Pelvis ...	Leak	?	+	+	—	+	—	—	+D	+	—	—	—	—	—	
Omentum	Leak	?	+	+	—	+	+	+	+D	+	+	—	—	—	—	
Liver ...	Post-operative ...	+	—	—	—	+	—	+D	+D	+	—	—	—	—	—	After eight days
Liver ...	Peritoneal rupture ...	+	—	+	—	+	—	++	—	—	—	+	—	—	—	Post-operative symptoms
Liver ...	Puncture	?	+	—	+	+	—	—	+ i.m.	+	+	—	—	—	—	

D = delayed action.

to multiple primary infestations, but they gradually recognised that many were due to secondary cyst formation from implanted scolices. Even as late as 1900, however, the view that such highly differentiated structures as scolices could, as it were, revert in their life cycle, ranked with many authorities as a biological heresy, as it seemed contrary to all the laws of the development of the cestodes laid down by Van Beneden. Much experimental work, however, has proved conclusively that such a retrogressive metamorphosis is not only possible, but relatively common, and of great clinical importance. Recognition of this has led to great advances in our conception of the pathology of hydatid disease.

Clinical Types.

Localised Secondary Echinococcus.—A common example of this is rupture of a subcutaneous or muscular cyst, when congeries of small secondary cysts, often called " seed " hydatids, are commonly found. Of a similar nature are those cases of post-operative or post-traumatic recurrence in the site of the original cyst—one type of local daughter cyst formation.

Secondary Cysts of the Peritoneum and Pelvis.—These are very common, and are due to leakage of scolices from a primary cyst of the liver, or, more rarely, of the spleen, kidney or omentum.

Occasionally the adventitia gives way, the intact parasite being extruded and gradually acquiring a new adventitia in a new site somewhere in the abdominal cavity. As no fluid is shed this event may occur quietly, with no anaphylactic symptoms and no resultant secondary cysts. This is an explanation of one type of primary pelvic cyst.

Usually, however, the cyst ruptures, hydatid fluid and scolices being shed into the peritoneal cavity with some anaphylactic shock. The scolices may be shed in thousands, and are carried by the rush of fluid, by gravity, or by intestinal movement as a rule to the lower quadrants. They soon become surrounded by lymph and eosinophil leucocytes, and are rapidly fixed in a secondary site. Doubtless many of them are overwhelmed and undergo fibrosis ; sometimes the peritoneal reaction around these disintegrating scolices is so extensive that a pseudo-tuberculous appearance is produced. Many, however, survive, become surrounded by a new adventitia, undergo vesiculation and develop into secondary cysts. As in the case of any other foreign body, the peritoneum gradually spreads over until the secondary cyst gives the appearance of having developed in an extra-peritoneal situation. It was non-recognition of this simple process that led many of the older pathologists to believe that these cysts were multiple cysts developed from numbers of hexacanth embryos.

These secondary cysts are of slow growth, there being a latent period of from five to twelve years during which growth takes place, until they in their turn produce symptoms. Owing to the usual rapid recovery from the initial rupture it is often misinterpreted by the clinician, and its true significance is unrecognised until at a later date the discovery of multiple abdominal cysts leads to a retro-

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spective diagnosis. It is thus not uncommon for rupture of a visceral cyst to occur in youth, but for its clinical manifestation and recognition in the form of multiple abdominal cysts to be delayed until adult age is reached. Secondary abdominal cysts are always multiple, often irregular in shape and size, and owing to the relative tenuity of their adventitia are prone to further ruptures with repetition of the above effects. As a result, the peritoneal cavity may become filled with hydatid cysts in all stages of development—a very grave condition, aptly described as hydatidosis.

Usually the rent in the primary cyst becomes occluded by adhesions, and the residual germinal elements produce multiple daughter cysts, one type of localised secondary echinococcosis. It is a general rule that when multiple peritoneal cysts are found there is also a primary visceral cyst containing daughter cysts. Somewhat similar phenomena to the above may occur following rupture of a cyst into the pleura or pericardium. Sometimes, of course, owing to the presence of a communication with a bile duct, intraperitoneal rupture of an hepatic cyst gives rise to leakage of the bile into the peritoneal cavity, with the production of a choleperitoneum, often a puzzling condition.

Metastatic Secondary Echinococcosis.—This gives rise to the rarest but the most interesting type of all secondary cysts, and is due to a rupture of a fertile simple cyst into the heart or venous system. The rupture may take place on the venous side of the circulation into peripheral veins or the right cardiac chambers, or into the arterial side, when it takes place into one of the left cardiac chambers. Two sets of sequelæ are possible. In both, of course, grave anaphylactic symptoms may occur, although as a rule recovery from the primary rupture takes place. If the cyst ruptures into the venous side of the circulation, the scolices are carried through the right ventricle into the lungs, where they are filtered out and give rise to secondary pulmonary cysts. These cysts are characterised by their multiplicity, their bilateral and peripheral distribution, and by their uniform size.

In the case of rupture into the left auricle or ventricle, the hydatid elements enter the systemic circulation and give rise to metastatic cysts in various parts of the body. Owing to the position and relative size of the carotid arteries, the majority of scolices are carried to the brain, which becomes the seat of the majority (60 to 70 per cent.) of these secondary cysts. Some scolices, however, may escape to the kidney, spleen or liver. All these are simple cysts of approximately the same size, rarely becoming larger than a hen's egg.

These examples illustrate the classical manifestations of secondary echinococcosis, which is now clearly established as regards its ætiology, pathology and clinical aspects. It is a general rule, in the case of multiple cysts, that if the extra-hepatic cysts are more than one-third of the total it is probable that they are secondary cysts.

Mechanical Effects of Rupture.

The mechanical effects of rupture of a cyst are seen in cases of rupture into a natural channel. Following the initial flooding, which is rarely serious, the

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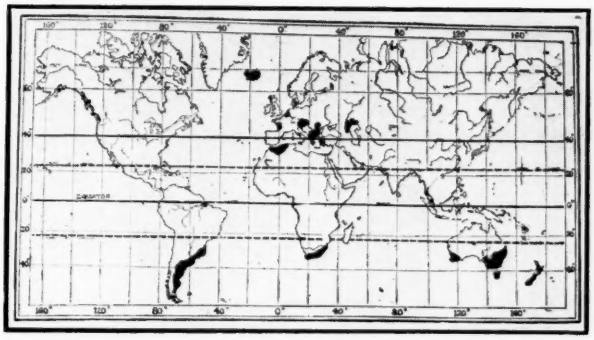

FIG. 1.—Map showing geographical distribution of hydatid disease.

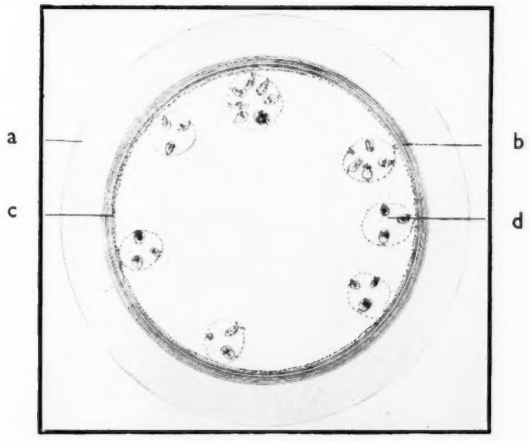

FIG. 2.—Schematic representation of a typical unilocular hydatid cyst, showing (*a*) adventitia, (*b*) laminated membrane, (*c*) germinal membrane, and (*d*) brood capsules containing scolices.

(*Article by* Harold R. Dew, F.R.C.S., *page* 481)

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passage of hydatid products along the channel leads to attacks of colic, or intermittent, partial or complete obstruction. These are immediate effects, although they may continue for months as fractional evacuation of the cyst contents occurs.

Micro-organisms do not find their way through an intact laminated membrane, and in the case of simple cysts some degree of rupture of this membrane is an essential preliminary to suppuration. Once the hydatid membrane collapses, however, some serum is exuded into the cavity, and with hydatid debris makes such an excellent pabulum for the growth of micro-organisms that when contact with a lining epithelium is made infection soon occurs. Small ducts may, however, open into the cavity, and yet it may remain aseptic for years, and occasionally actual repair of the opening may occur. Obviously the time that elapses between rupture and infection depends on a great number of factors, so that although infection may coincide with the rupture, it is often delayed for weeks or months.

Rupture of Hepatic Cyst into the Biliary Passages.—As an hepatic cyst continues to enlarge, it often causes a quiet pressure necrosis of the wall of a large bile duct, and if the opening becomes large enough some of the contents are forced into the duct. Such ruptures are relatively common, and I believe that some degree of intrabiliary rupture is the commonest complication of hepatic cysts. It may be a quiet leak with the passage of fluid and small particles of debris, or a frank massive rupture with or without occlusion of the main ducts with daughter cysts. This rupture takes place most commonly into the intrahepatic portion of the ducts, the passage of material down the ducts being helped by intracystic pressure, diaphragmatic movement and abdominal muscular action ; and once started, the slippery, non-irritating membrane is helped by the increased biliary flow after meals. In this way fractional evacuation of the cyst may take place into the duodenum. As is to be expected, this condition simulates complicated cholelithiasis very closely, this being the common diagnostic error. The following points are of interest in the differential diagnosis :

Age.—Hydatid disease tends to occur at a slightly younger age than stone in the common duct, *i.e.*, 30 to 40 rather than 45 to 55.

Sex.—In hydatid disease males are affected as commonly as females, whereas gall-stone disease affects females four times as commonly as males.

Pain.—The pain of hydatid disease is not so severe as true gall-stone colic.

Previous History.—In gall-stone disease there is usually a long history of flatulence, etc., though often completely absent in hydatid disease.

Examination of the Stools.—Examination of the fæces by washing should be used as a routine in all cases of jaundice. In hydatid disease the tough, bile-stained, laminated membrane, which resists putrefaction, is often discovered.

Hepatomegaly.—This is much commoner in hydatid disease than in cholelithiasis.

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Jaundice.—A characteristic of hydatid disease involving the ducts, present in 80 to 90 per cent. of the cases. In gall-stone disease gross persistent jaundice is rare, and is practically confined to cases of stone in the common duct.

Radiography.—This should be applied as a routine, as it may indicate sub-diaphragmatic distortion or calcareous change in a cyst.

Immunological Reactions.—These are of the utmost value. The use of the hydatid complement-fixation test and the intradermal test of Casoni has revolutionised the diagnosis of hepatic hydatid in Australia.

Hepato-Bronchial Fistula.—This is not uncommon, and is due to rupture through the right diaphragmatic cupola by way of adhesions into the bronchus. The patient first expectorates daughter cysts and bile-stained debris, and later foul-smelling pus. All sorts of other complicated pictures due to another co-existent rupture may occur, and unless the surgeon is alive to the vagaries of hydatid disease, mistakes in diagnosis, treatment and prognosis are inevitable.

Rupture into the alimentary canal may also occur, with occasionally natural cure, although as a rule suppuration causes a rapid, grave alteration in the picture. Rupture into the urinary passage may occur in the case of renal or pelvic cysts with a close simulation of renal colic. It, too, is prone to infective sequelæ.

Rupture of a Pulmonary Cyst into a Bronchus.—This is the natural end of most pulmonary cysts, because by the time a cyst reaches a diameter of four to five inches it nearly always comes into contact with a large bronchus, the erosion of which causes a small part of the cyst wall to become unsupported. Following a cough, a muscular effort, an injury, or even spontaneously, the cyst wall gives way and the contents enter a bronchus. Although partial rupture may be masked by hæmoptysis and bronchial secretion, as a rule a comparatively large amount of fluid rushes into the bronchus. Rarely the patient is asphyxiated by the fluid or by the impaction of membrane in the glottis. More usually the dramatic symptoms are anaphylactic in nature.

After rupture the patient usually recovers rapidly, although for some time repeated expectorations of fluid and gradual evacuation of the cyst contents may occur. The patient may have attacks of coughing and hæmoptysis, but remain afebrile and in good health throughout. Natural cure depends on the size of the cyst, as on it will depend the thickness of the adventitia and the possibility of complete collapse, and the time taken for disintegration and expectoration of the cyst wall. As is to be expected, small cysts and cysts in children more readily undergo natural cure. The larger the bronchial communication and the more dependent its position, the better are the chances of evacuation. Apical cysts are more likely to involve bronchi while yet small, and the opening will probably be dependent, facilitating drainage. Deeply placed parabronchial cysts also fulfil most of these conditions, and all are agreed that these should not be attacked surgically, and that if left alone about 75 per cent. will undergo natural cure.

In a great many cases the cavity becomes infected, at first with saprophytic,

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but later with pathogenic organisms, at first of low virulence, but later with virulent cocci and often anaerobic gas-producers. The adventitia become thickened and lined on the inner aspect with a pyogenic membrane, and the clinical picture becomes one of intrapulmonary abscess, which necessitates surgical intervention.

Hydatid Pneumothorax.—Another interesting type of rupture is that of a subpleural pulmonary cyst into the pleural cavity. This may be comparatively

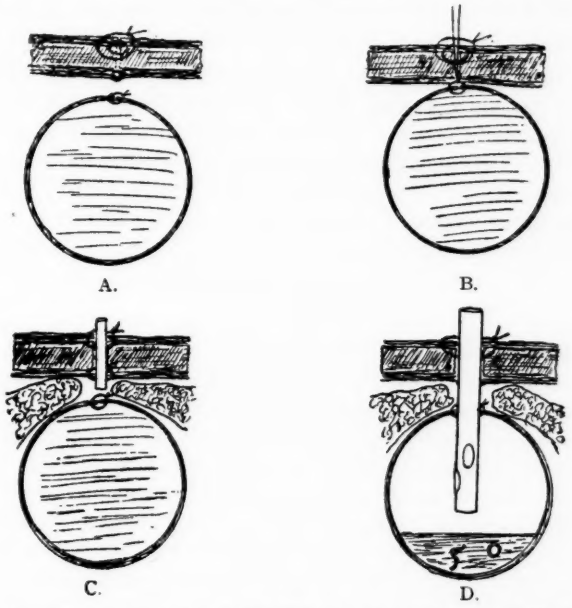

FIG. 3.—Schematic representation of the various methods of dealing with the cavity of a hepatic hydatid after evacuation. (A) Filling with saline and closure without drainage. (B) Filling with saline and closure and suturing to peritoneum. One suture is brought out. (C) Filling with saline, closure, and placing of a drain down to the suture line. The omentum is in position. (D) Open drainage. The omentum is in position.

quiet, with immediate anaphylactic symptoms or the formation later of secondary pleural cysts.

As a rule, however, the subpleural cyst is large enough to have also involved a patent bronchus, in which case a pneumothorax follows. Hydatid pneumothorax, occurring as it does in a previously healthy patient, may be most dramatic. At first the effect is mechanical, although the mild irritation of the pleura often leads to a hydro-pneumothorax. In the majority of cases, however, infection leads to a pyo-pneumothorax.

This condition may be confused with tuberculous pneumothorax, but, unlike that disease, it is common in adolescents, more common on the right side; there

is rarely any suggestive previous history, no signs are present on the opposite side, tubercle bacilli are absent from the sputum, anaphylactic symptoms are common, and the typical hydatid immunological reactions are often positive.

Death of the Parasite.—Following aseptic rupture into a natural channel, and occasionally apparently from unknown causes, the parasitic fluid may be evacuated or absorbed, the parasite dies, and a collection of inspissated material containing cholesterin and crumpled hydatid membrane is left. This becomes enclosed by fibrous tissue which contracts and often shows calcareous deposition. Such dead cysts are not infrequently found at autopsy.

Suppuration.—Suppuration is a constant risk in all cases in which rupture into a natural channel has taken place. It may be for long delayed, but unless complete evacuation through a relatively dependent opening takes place, the hydatid debris and serum make such an excellent pabulum for bacterial growth that suppuration is always likely to occur. When it does, the patient exhibits signs and symptoms typical of an abscess of the area involved, with a rapid alteration of the clinical picture.

Diagnostic Methods.

Radiography has revolutionised the diagnosing of intrapulmonary cysts, as the saline cystic contents are relatively opaque, and give a characteristic shadow. In subdiaphragmatic cysts elevation of the diaphragm is a very striking feature, and can often be detected. Calcareous changes in the adventitia are also often noted in the case of abdominal cysts. Routine X-ray examination alone, however helpful it may be in pulmonary cases, often fails in young subjects with cysts of a moderate size, and in Australia this method of examination has been supplemented by immunological methods. The precipitin test, as utilised by Fleig and Lisbonne, has given way to the complement fixation test as modified by Fairley, using fresh hydatid fluid from sterile sheep cysts as antigen. In addition, the intradermal test of Casoni has, in our hands, proved itself of the utmost value. By the combined use of these methods 90 per cent. of hydatid cysts are now confidently diagnosed.

Treatment of Hydatid Disease.

Simple clean cysts should be exposed by open operation in one or two stages —general anæsthesia being preferable except in pulmonary cases. Part of the fluid is then removed by puncture, taking care not to contaminate the wound with scolices; then 10 per cent. formalin is injected in a sufficient amount to make a 1 per cent. solution in order to sterilise the hydatid elements. After a few minutes the cyst is evacuated with a pump, the cavity filled with saline and sutured without drainage. In any complicated cyst or in cases where suppuration is present or there is an opening into a natural channel, dependent drainage is carried out, the after-treatment being on general lines. These methods are illustrated schematically in Fig. 3.

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Echinococcus Alveolaris.

This peculiar form of hydatid disease was first recognised by Virchow, who discovered the parasitic nature of a disease which was formerly regarded as a colloid carcinoma. Much controversy has raged concerning its exact place in the pathology of this disease. It is most common in Central Europe, and for long was considered to have this narrow geographical distribution. The disease is characterised by its infiltrating nature, its tendency to grow "exogenously," by its slow persistent course, by its tendency to central necrosis, and by its ultimate fatal ending. Reference should be made to standard works for a further consideration of this rare disease.

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REPORT ON THE FIFTEENTH INTERNATIONAL PHYSIOLOGICAL CONGRESS

Held in Leningrad and Moscow, August 8th to 18th, 1935.

By J. YULE BOGUE.

THE Congress was held in Leningrad on August 8th to the 16th, and in Moscow on the 17th and 18th. There was an informal reception on the evening of August 8th, in the Marble Hall of the Ethnographical Museum. This reception was well attended and gave members an opportunity of meeting and being introduced to scientific workers from other countries. It also gave one a forecast of the lavish scale on which the National Committee and the Soviet Government entertained their guests.

The first plenary session was opened by Professor I. P. Pavlov at the Uritzky Palace. An impressive tribute was paid to the memory of Sir E. Sharpey-Schafer and Professor J. J. R. Macleod, when all the members stood while Chopin's funeral march was played. The arrangements for the plenary sessions were admirable. At each desk there were a pair of headphones and five sockets into which they could be plugged, so that it was possible to follow the speaker or an interpreter in English, French, German or Russian. After an address of welcome by the President of the Leningrad Soviet, the first paper of the meeting was read by Professor W. R. Cannon (Boston), entitled "Some Implications of the Evidence for Chemical Transmission of the Nervous Impulse."[1]

This paper fell into two main sections: the first dealt in an admirable manner with the position of the physiologist and the conditions under which he works

at the present time in the different countries. The second part constituted a general outline of our knowledge of the chemical transmission of nerve impulses (the neurohumoral hypothesis). It covered the field worked on by Dale, Feldberg, Rosenbleuth, Loewi, Langley, Lucas, Parker and Bacq, etc. The session was followed by the general meetings, at which 485 papers were read. Five sections sat at one time, the papers being grouped into sections according to subject, there being thirty-one sections in all. Papers which ought to be of special interest to the Ministry of Agriculture are dealt with below. It was difficult, however, to attend all the papers one wished to hear, since there was a considerable amount of overlapping of sections and in some cases last-minute changes in the official programme.

I did not get a great deal of information from the meetings themselves, since the time for each paper and discussion was naturally short; much, however, could be gathered by individual discussion outside and by attending the demonstrations. In future congresses there will be no presentation of papers, but members will have their communications printed and these will be circulated before the Congress. Those who wish to take part in the discussion will inform the Organising Committee. The papers will then be grouped and so arranged that there will be an organised discussion on the subject. This opportunity for interchange of opinion and discussion should considerably add to the value of such meetings. It was decided to put this scheme to test at the Sixteenth International Congress which is to be held in 1938 in Zurich.

The second plenary sitting was opened by Professor Orbeli (Leningrad), who gave a paper entitled " Pain and its Physiological Effects "; this was followed by another interesting paper by Professor Sir J. Barcroft (Cambridge), entitled " Velocities of Some Physiological Processes." This dealt mainly with the respiratory system and included reference to much of his work already published in this country.

On the last evening in Leningrad the Congress was invited to a banquet by the Organising Committee and the Leningrad Soviet at the Dietskoye Selo in the Catherine Palace. It was a splendid affair in ideal surroundings; this and the firework display, etc., however, were perhaps not quite in keeping with the atmosphere of a scientific congress, it savoured rather of film directors and Hollywood.

On the evening of August 16th the Congress entrained for Moscow. On the 17th there was the final plenary sitting at which two scientific papers were given, the first by Professor L. Lapicque (Paris), " Progrès récents dans la connaissance du mécanisme nerveux." A considerable portion of Lapicque's work is at present a matter of controversy, and is of no particular immediate interest to the Ministry. The second paper was presented by Professor A. Ukhtomsky (Leningrad), " Physiological Lability and the Act of Inhibition." I, personally, was quite unable to understand this address, as the speaker was inaudible to most of the audience. The Congress then discussed the place of the next meeting and its organisation, the main feature of which I have already mentioned.

A banquet was given in the Kremlin in the evening, and this terminated the official part of the programme. During the sittings at Leningrad and after the plenary sitting in Moscow there were a series of excusions to various scientific institutions.

The research centres were of great interest: in each there is a permanent demonstration of the work of the institute and its progress. On arriving at an institute the visitors were divided into groups and first given a short résumé of the work done and proposed, this was usually illustrated with large charts and wall diagrams. Some were of great interest, while others were definitely of a propaganda nature, showing the difference between the conditions before and after the Revolution. The demonstrations showed mainly the expansion of scientific work, laboratories and workers under the Soviet; this expansion has been enormous. Before the Revolution there were 23 institutes carrying out work of a physiological nature, at the present time there are 380; there has been an even greater increase in the personnel. One of the most striking is perhaps the V.I.E.M. (the All-in Institute of Experimental Medicine). In 1931 the staff was 393, and in 1935 is over 2,200. Biological research is being developed to an enormous degree. Special attention is being directed to industrial physiology and to the physiology and care of mother and child. It might not be out of place to give an indirect example of this: Expectant mothers cease work at the factories eight weeks before delivery is expected; six weeks in the case of office workers. They receive full pay and prenatal attention, this applies to every woman, whether single or married. It is forbidden to discharge a pregnant woman without adequate reason and a special inquiry. There is a further period of eight or six weeks with full pay after confinement, with frequent medical examination. When the mothers return to work they are then allowed off every three and a-half hours to feed the child, which is kept in a children's institute near the factory, usually on the other side of the road. In the main towns the railway stations have well-equipped premises for bathing and feeding children of all ages, there are also medical men in attendance. There are very definitely no such facilities at the smaller stations such as at Rostov or Yaroslav, where the conditions are appalling.

The Soviet scientist appears to know very little about what is being done in other institutes outside the Union; very few have had the opportunity of studying abroad. Foreign scientific journals and books are scarce: this is due to the exchange problem. One therefore frequently comes up against work being done which would be completely altered if the person concerned only had some knowledge of what others had done in the same field.

About fifty of us attended a demonstration and tour of the Lenin Academy of Agricultural Sciences in Leningrad, and Dietskoye Selo, on Sunday, August 12th. The director delivered an address summarising the work of the institutes under the control of the academy. This dealt with plant physiology. Several problems and their solution impressed the writer very much, though, of course, I am not

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in the position to be able to give a critical review of the work, since I am not a plant physiologist. They have succeeded in introducing a rubber plant which can be grown in the Union ; the importance of this was said to be somewhat offset by the fact that over 95 per cent. of the rubber used is synthetic. The plant is apparently capable of yielding 35 per cent. of sap from its root.

The wheat problem has been very thoroughly investigated, and the results of their world expeditions and collection of all the known varieties has been the production of strains which can be adapted to almost any region in the Union. The system is roughly as follows : Various varieties and crosses are tested out and evolved at the central experimental station, these are then sent out to all the experimental area stations in different parts of the Union for practical tests. The results are then returned to the control centre in Leningrad, where they are tabulated and filed ; these results include rate of growth, yield, disease resistance, quality and so on. Each successful variety is then carded ; this simply means that a specimen of the ripe wheat is attached to a card with its botanical and local name ; there is also a specimen of the seed alone in a glass container glued to the card. The average yield, quality, flour yield, and so on, is also stated. There is also a map on which is marked the best areas for production and a second best area. Such cards are then sent out to the districts concerned. Only wheat which is classified in this manner may be grown, and it can only be grown in the areas marked on the map. Should anyone attempt to grow any other variety in an area which is not suitable, the would-be experimenter is so dealt with that it precludes the possibility of any further repetition.

The difficulty of producing a fertile strain of geranium has also been overcome in a very simple manner. As is well known the geranium is sterile ; it was found that all that was necessary was to double the chromosome number ; this was achieved by cutting the tops off the plant. There was a large plot of such plants at the Dietskoye Selo, as the oil is in great demand in the Union. These plants can be grown from seed.

The sweet and bitter pea are also of importance, since they will grow on barren soil and serve to manure it. But the bitter pea has the disadvantage that it cannot be used for meal or food, whereas the sweet pea can. Unfortunately, however, the bitter predominates and there is no known method outside Germany of identifying the sweet and bitter variety seeds. Vavilov, therefore, paid a visit to Germany, and was informed that the process of identification was a State secret of the Nazi régime, and that the seeds could only be bought ; the method therefore has not been published. Vavilov returned and gave his chemists three months in which to find a test which would be easy and quick to carry out. In six weeks a test was evolved which is specific : it is an iodine test, the technique and results are in the course of publication.[2] It turned out that there were only 3 in 100,000, or even less, seeds of the pure-breeding sweet variety. Girls sorted and tested 2,000 seeds a day and they now have a large plot of this pure variety. These will grow under the same conditions as the bitter variety, but have the

advantage in that this variety can be made into meal which is to be used for human and animal consumption.

Experiments were also being done on the effects of artificial light on various plants. There was also an interesting experiment on the indoor germination of wheat, but I did not have time to go into it.[3]

The writer also paid two visits to the All-in Institute of Animal Breeding, directed by Professor Zawadovsky.

Artificial Insemination.

Intensive work is being done in this field; the Institute appears to have developed an advanced technique in dilution. Demonstrations were given of the techniques applied to horses, cows and sheep. The methods of collecting the ejaculate appear to me to be the best so far. They are now able to dilute the spermatozoa so that one ram can supply a sufficient quantity to allow 2,000 ewes to be artificially inseminated in a season. The diluted spermatozoa can be kept under suitable conditions for a considerable period, thus enabling transit to various stations within a certain area. These methods are being tried on all manner of livestock, but special attention is being given to the horse, cow, sheep and swine. These methods are now in the stage where they can be passed on to the various sub-centres for general use; these experiments are being conducted on a very large scale. I had two discussions with Professor Zawadovsky and was able to listen to two demonstration propoganda talks. The substance of the four meetings was very much the same, and is summarised in two publications of collected papers from the institute.[5]

I do not think I can do better than give a summary of that which can be read in these two publications: The main principle of the work is not the transfer of laboratory work to the farm animal, but experimental work on the farm animal directly. This is, of course, only possible in a state where all the farms are under central control.

Nutrition: the evaluation of the nutritive value of various foods. The treatment of such foods in order to increase the digestibility by chemical and biological methods—the advantage of treating roughage so that it is more easily digested—seems to me to be doubtful, as it may upset normal physiological processes in the long run. Admirable studies are being made on the comparative physiology of the digestive systems of the different domestic animals, special attention being directed to the effects of different foods on the secretory mechanism of the intestine.

The effect of various types of feeding on meat production, being carried out on the usual lines, deserves no special comment. Methods are also being worked out for large-scale feeding of irradiated yeast and food acted upon by radium rays or ozone for the purpose of increasing the vitamin content.

A general résumé of the work includes the early diagnosis of pregnancy in horses, pigs and cows. Production of heat and ovulation, increasing the egg

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production of the hen, the influence of endocrines on milk production and fattening. Interesting studies have also been made on the effect of hormones on feather, down and wool. Zawadovsky himself is paying particular attention to the interaction of the various endocrine secretions, their connection with metabolism, and the practical application of such findings to the collective farm system.

Moulting and Feather Plucking.—The following papers have been published on this subject: A test of the hyperthyroidisation method for the purpose of facilitating plucking of feathers and down from slaughtered geese. The application of hyperthyroidisation on geese for the repeated collection of feather and down. The influence of repeated thyroidism on repeated moulting in geese. On the application of the method of hyperthyroidisation for the purpose of facilitating and accelerating the process of pinching the feathers out of killed hens. Two papers on the effect of the male sex hormone on hyperthyroid moulting.

There are nine further papers on the mechanism, interrelation, depigmentation, metabolism, etc., of hyperthyroidism. Summarised briefly, the work shows that thyroid feeding facilitates the ease with which a chicken or goose may be plucked, there being a saving of 30 to 40 per cent. in time; but this is offset by the fact that such treatment results in a loss of appetite and consequent loss in weight; this, therefore, precludes the application of this method on an industrial scale. Work is being carried out to overcome this, and it appears that if cod-liver oil, green food and charcoal are given that the loss of weight and appetite are prevented without interfering with the hyperthyroid moulting. Feeding the dried thyroid gland in the food is the usual method of administration. Eight thousand hens were used for these experiments in the Ukraine.

Egg Production.—Efforts are being made to increase the normal egg production and to prevent the decrease during the moulting period. Injections of folliculine gave negative results, whereas prolan was said to stimulate egg production, but did not prevent the decrease with moulting. Prolan and folliculine together are claimed to increase the egg production and to prevent to a certain extent the decrease during the moulting period. But this was contradicted by a later paper where hens were studied under battery conditions; prolan, ovariolysat, myolysat (these lysates will be discussed below), and placenta from cows were tested as egg stimulators. These workers concluded that not one of these methods was of any use in battery conditions. It appears to me, therefore, that up to the present this work has been abortive.

Lysates.—Some work is being done on lysates; lysates are protein extracts which are reputed to have general stimulating effects on the heart, muscles and ovaries; in fact on every organ in the body. These results should be examined with caution, as results can be obtained with extracts from tissues from any part of the body, and it is therefore very unlikely that this work is of much value unless it is adequately controlled, and it is on this latter point that I found my objections to this work. I was quite unable to get any satisfactory data from the workers concerned in this field.

Fattening with Insulin.—Insulin was given to pigs fed on garbage. The average gain in weight during the period of insulin injection was 4.2 per cent. But the cost of feeding was 30 per cent. less than in the controls. It is said that the insulin may considerably increase the assimilation of carbohydrates. The authors of this work are cautious and state that further experimentation is needed before the method can be justified. The effects were also tried out on hens and pullets: on hens negative results were obtained, but there was a marked influence on pullets, which showed an increase in weight. Hens after ten days showed a decrease in food consumption, but this was not noted in pullets and cocks.

Lactation.—Repeated injections of alkaline extracts of anterior pituitary extract to cows on pasture three to five months after calving caused an increase in milk production without any subsequent depression. Prolan had no stimulating effect whatever. Injections of mammolysat and prolan were tried out in ewes. Prolan had no effect, but mammolysat was said to have a stimulating effect which lasted for not less than one month after a single injection of 1.5 c.c. of a 1 per cent. solution. In rabbits prolan caused an increase in the mammary glands, but had no effect on the milk yield. But extracts of anterior pituitary increased the lactation in normals and castrates, but it was impossible to induce lactation more than twice successively in rabbits or dogs, normal or castrated. Further experiments on cows with anterior pituitary extract showed that a single injection of 30 to 40 c.c. of the alkaline extract increases the yield by one to three litres, this lasts for two to four days, after which there is a return to normal. Repeated injections are said to avoid this return to normal. These injections do not cause abortion. But these experiments should not be carried out in the later stages of pregnancy and lactation.

Pregnancy Diagnosis.—The hormonal method of the diagnosis of pregnancy in cows was attempted by means of urine extracts. Oil extraction was the most satisfactory. Urine is acidified with sulphuric acid and boiled for ten to fifteen minutes, this is an essential part of the procedure. Diagnosis up to thirty days was unsatisfactory. Later, *e.g.*, one to three months, diagnosis was often possible, but was not reliable, since negative results could not be relied upon. The method is therefore unsatisfactory.

In the case of swine, on the fourteenth day after coitus pregnancy could be detected. The urine is treated with alcohol or ether, the extracts being injected into mice, which show marked uterine changes. This work is also being carried out on mares, but I have been unable to obtain any data. Work is also being done on the production of ovulation by hormonal means, especially on silver foxes, this work is proceeding on the usual lines, and is yielding results which are being confirmed elsewhere.

This, I think, covers the work being done at the Institute. Some of the results are of great interest, but much of the work should be accepted with reserve until further experiments and controls are made. Much of this work was reported

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at the meetings; there were also demonstrations of the apparatus and photographs showing the various techniques and many large charts. A general summary of the subjects and their origin is shown below:

Subject.	No. of Papers from U.S.S.R.	No. of Papers other countries.
Biochemistry	20	69
Circulation and heart	4	19
Applied physiology	8	4
General and cellular physiology	24	51
Metabolism, nutrition and vitamins	4	28
Internal secretion	8	25
Excretion	2	9
Nervous system and nerve muscle physiology ...	65	59
Pharmacology	15	19
Physical factors in biochemistry	5	8
Sense organs	11	13
Sexual cycle	4	11
	170	315
	Total 485	

As soon as I receive a copy of the summaries of the communications I will forward it to the Ministry.

REFERENCES.

[1] A copy of Prof. Cannon's address will be forwarded if required.

[2] Samples of the seeds and the technique have been promised should the Ministry be interested. Copies of these publications have been promised.

[3] Reprints have been promised if required.

[4] Dr. Mirskaia, who used to be at Prof. Crew's department, has promised to collect any information required. This will materialise should the Ministry require it. Dr. Hammond is, however, well acquainted with this work; there is contact between Cambridge and Moscow.

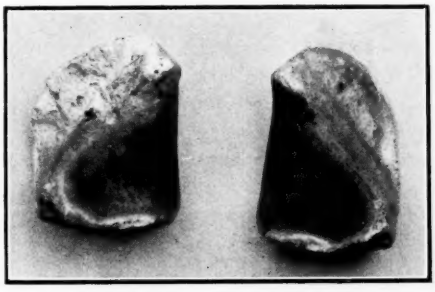
[5] I can obtain the two volumes referred to if necessary. Should there be some delay I can forward my own copies to the Ministry. The papers are in Russian with English summaries.

REPORT OF THE SPECIAL COMMITTEE ON FUR-BEARING ANIMALS, Etc.

Presented to the Council of the National Veterinary Medical Association on July 2nd, 1935.

THIS Committee was appointed by the Council to explore means of bringing about the collaboration of the veterinary profession and members of the rabbit, fur-bearing animals, pigeons and aviary birds industries. The Committee was constituted as follows: Major Hamilton Kirk (Chairman), Major T. Dalling and Mr. K. D. Downham, together with Miss A. M. Catchpole, Mr. Henry Gray, Dr. Tom Hare and Professor W. C. Miller as co-opted members.

Photograph of Fetlock Joint.



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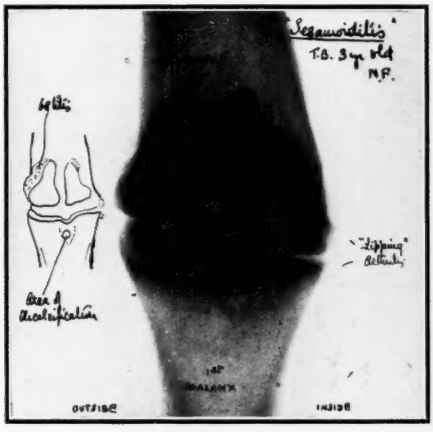

"A.P." Radiograph of Joint.

(*Article by* V. Berwyn Jones, M.R.C.V.S., *page* 502)

From information supplied by members of the Committee it is apparent that the commercial value of the fur-bearing animals and birds, including pigeons, aviary birds and wild game, bred in this country is very great. The following are a few examples:

(1) The Silver Fox Breeders' Association have on their register some 7,000 breeding foxes of a value reaching to about £125 per pair.

(2) Mink is being bred to a considerable extent and their number is increasing. The value of a breeding unit consisting of three females and one male is about £50. Each years shows an increase in the number of fitch, racoon, fisher martens, etc., bred for their fur.

(3) There are many large aviaries housing hundreds of birds. It is understood that the upkeep of one of the largest private collections costs £10,000 per annum. The export trade in canaries is valued at about £50,000 per year, individual birds making up to £20.

(4) The rabbit industry is colossal. It is estimated that there are at least 70,000 breeders in this country; new breeds are being established, and a sum as large as £50 has been paid for a specimen of the new "Rex" variety.

The Committee had before it much evidence of a similar nature, but it is felt that the above examples suffice to show the large commercial value of these industries. It was further pointed out to the Committee that in addition to the financial value of these industries, the sentimental value attached to the individual animal or bird is of considerable importance.

A review of the evidence laid before the Committee shows definitely that veterinary surgeons are not well acquainted with the habits of these animals nor with the ailments from which they suffer. The Committee regrets to point out also that it has been forcibly demonstrated to it that the breeders concerned are perfectly well aware of these facts. The result of all this is that veterinary surgeons are not of much assistance to these industries at the present time, and that the industries are suffering from a lack of adequate veterinary advice. As an example, the attention of the Committee was drawn to a case in which a veterinary surgeon, together with a member of the medical profession, certified certain animals as free from some specific diseases. These animals were exported, and on examination by the veterinary authorities abroad were found to be affected so badly with the diseases from which they were certified free, that their immediate destruction was ordered. Incidentally, such an incident must cast grave reflection upon the veterinary profession in this country.

Recommendations.

Teaching.—The Committee considers that one of the best methods of remedying the present unsatisfactory position is by the adequate training of veterinary students in the general husbandry and diseases of these animals. To this end it suggests that representations be made to the Royal College of Veterinary Surgeons for the inclusion in the examination syllabus of the diseases of these animals

and birds, so that students may obtain the necessary training in the various subjects concerned. The attention of the Committee was drawn to the reply given by the Royal College of Veterinary Surgeons to a letter, referred to them by our Association, from the National Poultry Council concerning the amount of teaching at present given in diseases of poultry. The Committee feels that, notwithstanding that reply, the matter of further instruction in diseases of birds and fur-bearing animals is urgently necessary.

Research.—The Committee reviewed the various researches which have been carried out during recent years in connection with diseases of these animals and birds. While appreciating that a considerable advance has been made, the Committee is of opinion that a large amount of further research is required, and to this end it recommends the provision of Research Scholarships. It is understood that some of the larger breeders' associations would, if approached, be willing to assist financially in establishing and maintaining such scholarships.

Co-operation.—The Committee felt that much good would accrue from inviting officials of the various breeders' associations as guests at appropriate functions held by the profession.

Clinical Articles

SESAMOIDITIS.

By V. BERWYN JONES, M.R.C.V.S.
Wonersh, Guildford.

THIS case of sesamoiditis and arthritis in a very well bred animal, a Derby entrant, is of particular interest because of the extensive ulceration of the joints, together with the decalcified area at the head of the first phalanx. This decalcified area gives a radiographic picture almost exactly corresponding with that found in radiographs of navicular disease. The radiograph, post-mortem photographs of the joints and boiled sesamoids are self-explanatory. (*See* plates.)

Obituary

CAPTAIN WILLIAM BARONS NELDER, F.R.C.V.S.

BY the death of Captain Nelder, Exeter loses one of its most respected citizens and the West Country one of its best-known veterinary surgeons. Born in 1864 of Yeoman stock, Captain Nelder was brought up amongst the animals of the farm. He served his pupilage with Mr. John Collings, of Exeter, and entered the London College, from which he graduated in 1887. For some little time he then acted as

assistant to Mr. Squire, of Tavistock, and eventually settled down in Exeter, purchasing the practice of Mr. J. A. Collings. Here he soon built up a reputation, and his opinion was sought for far and wide amongst the hunting and agricultural communities. There was no man whose opinion on a horse was more reliable, and he always called a "spade a spade." In May, 1903, he joined the Royal First Devon Yeomanry as veterinary officer and served in that capacity for a number of years. At the outbreak of War, in August, 1914, he was immediately mobilised and served in the Army until invalided out in 1917. Retiring from active practice in 1931, Capt. Nelder handed over to his son, who had also qualified from the London school. It was impossible, however, for a man with his reputation and ability to be allowed to remain idle, and during the last few years of his life his opinion was continually being sought as a consultant by his brother practitioners, and in many cases of dispute where an experienced umpire's opinion was necessary.

Reviews

A Guide to Human Parasitology for Medical Practitioners. By D. B. BLACKLOCK, M.D. Edin., D.P.H. Lond.; and T. SOUTHWELL, D.Sc., Ph.D., A.R.C.Sc. Second edition. Pp. viii + 269. Two coloured plates and 122 illustrations in the text. Royal 8vo. London: K. H. Lewis & Co., Ltd. Price 12*s*. 6*d*. net.

THE publication of a second edition of this "Guide to Human Parasitology" has enabled Professor Blacklock and Dr. Southwell to revise their text and to take advantage of comments, advice and critical suggestions put forward either by individuals or in the various reviews of the first edition. The book is written primarily for the medical practitioner and post-graduates who take courses of instruction for the Diplomas of Tropical Medicine or of Tropical Hygiene and Public Health, so that to the veterinarian it is of secondary interest. The first 28 pages of the text are given over to introductory remarks in which the student is guided in the use of the microscope (beginners in the study of veterinary as well as human medicine could read this section with advantage) and in the examination of material such as blood and fæces. There follows a chapter on spirochætes. The section dealing with protozoology, embracing six chapters, is mainly of medical interest, although information on *Trypanosoma gambiense* is of interest to the veterinarian. The section on helminthology treats of the three classes: Trematoda (three chapters); Cestoda (four chapters); and Nematoda (three chapters). The principal features required for the recognition of each parasite are given and the text is free of unnecessary details. Veterinary students will find the classification applies primarily to human parasites, and is of insignificant use when applied to the forms infesting domesticated animals. It is generally understood that parasitology, as an applied biological science, embraces entomology as well as helminthology and protozoology; but in this text the arthropods, even of medical interest and importance, receive scant attention. Some six pages constituting Chapter XXII, and headed "Myiasis," is apparently devoted to parasitic insects, although actually two-thirds of the chapter deal with congenital infections, with spirochætes, protozoa and helminths. On the whole, the text is well written and the subject matter treated in a way that one would expect of two authors whose teaching experience is considerable. The numerous tables, illustrated life-histories and keys ought to prove very helpful to the student. Medical students will find in

this text information which should be of real help in their study of parasitology; veterinary students, on the other hand, cannot expect to find the same help from it, simply because it deals with human and not veterinary parasitology.

J. N. OLDHAM.

" Nature." May, 1935.

THE Jubilee edition of *Nature*, May, 1935, contains a collection of articles whose object is to give a *précis* of the progress made in the sciences during the last twenty-five years under royal patronage. As science has no natural partitions, either in space or time, it states that no one research can be limited to a particular period, but it so happens that the last twenty-five years has seen a greater number of discoveries and advancements than any corresponding period in the history of the world. The best articles include " Discovery and Significance of Vitamins," by Sir Frederick Gowland Hopkins, P.R.S., which is a complete survey of vitamin work. " Genetics since 1910," by Professor J. B. S. Haldane, F.R.S.; " Diet and Disease," by Professor Stuart J. Colwell; and " Virus as the Cause of Disease," by Dr. J. A. Arkwright, F.R.S. Other articles include " Cosmic Rays," by Dr. Arthur H. Compton; " Twenty-five Years in History," by F. S. Marvin; " Structure of the Universe," by Sir James Jeans, F.R.S.; and " Heat Production of Muscle and Nerve," by Professor A. V. Hill, O.B.E., F.R.S. Further articles refer to progress made in engineering and electricity. In all there are thirty articles, of which eighteen are by Fellows of the Royal Society.

New Preparations

'WELLCOME' BRAND CALCIUM BOROGLUCONATE.

BURROUGHS WELLCOME & Co. announce the issue of 'Wellcome' Brand Calcium Borogluconate for the treatment of milk fever in cows according to the method evolved by Dryerre and Greig (*Veterinary Record*, April 20th, 1935). The product is issued in cartons, each containing 2½ ounces of 'Wellcome' Calcium Borogluconate. The contents of each carton, which constitute one curative dose, are dissolved in sterile water and injected subcutaneously. It is stated that cows liable to suffer from milk fever at successive parturitions can be protected by the administration of one or two ounces dissolved in five to ten ounces of sterile water immediately after calving, and again about twenty hours later. A leaflet giving full particulars of the treatment will be forwarded by the makers on application.

Personal

Principal Craig was presented with a silver tea-service by the Veterinary profession in Ireland and graduates of the College as a farewell gift on his departure for Liverpool. Professor Craig has been on the staff of the Dublin Veterinary College for over 30 years and has recently been appointed to the Chair of Comparative Pathology in the University of Liverpool.

Whole-time Appointments.

Three more appointments have recently been made in Cheshire, the selected candidates being Mr. Chas. A. Stewart, M.R.C.V.S., Mr. John Macbeth, and Mr. Bernard Brown.

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